RingMaster™ Software

Monitoring and Management Guide

Release

7.5

30 June 2011 (Release Date)
Part Number: 730-9502-0232, Revision C

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Juniper Network, Inc.
1194 N. Mathilda Avenue
Sunnyvale, CA 94089
USA
408-745-2000
www.juniper.net

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RingMaster Services

This chapter describes the use of *RingMaster Services* software.

Starting or Stopping RingMaster Services

The method for starting and stopping *RingMaster Services* depends on the platform on which the service is installed:

- *Windows* systems — *RingMaster Services* are started automatically when you complete installation and start automatically whenever you restart your system.
- *Linux* systems — You can start and stop these services manually from the command line using a shell script installed when you install *RingMaster Services*. You can configure services to start and stop automatically.
- *Macintosh* systems — *RingMaster Services* are not started automatically — you must start them manually.

All clients using *RingMaster Services* should be closed before you stop services. If a *RingMaster Client* is using a network plan on *RingMaster Services* when you stop the services, you cannot select objects or options in the client. In this case, to close the client, click the **X** in the upper right corner of the window or use Task Manager to end the client session.

Windows Systems

You can start *RingMaster Services* on a *Windows* system from within *RingMaster* or from **Windows Services**.

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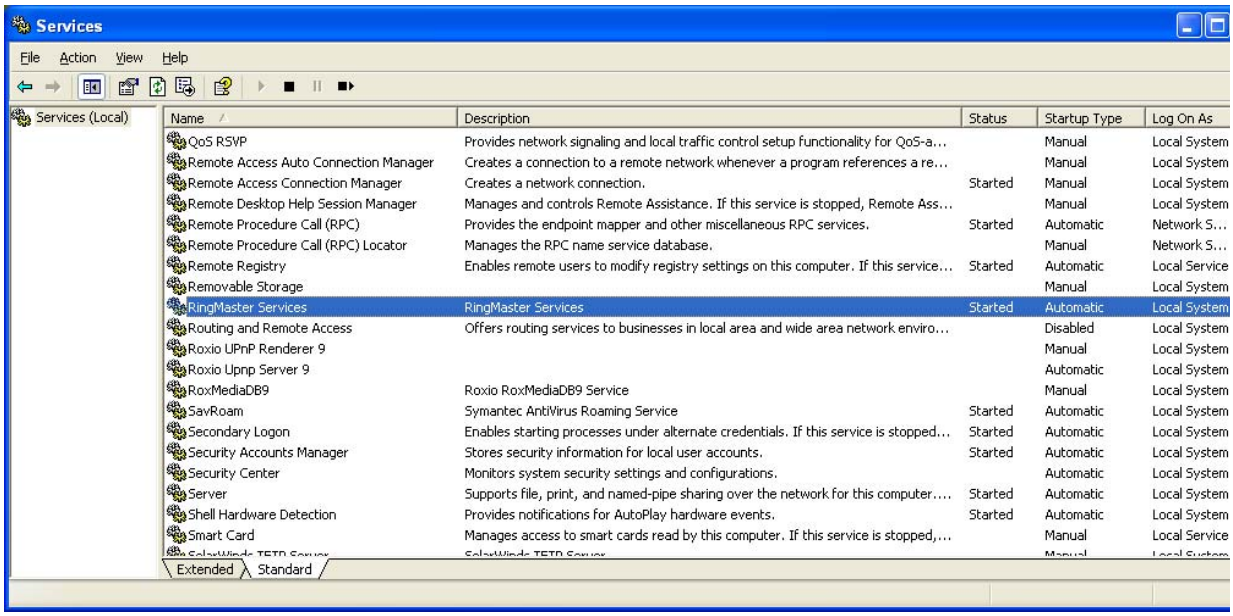
1. Display the **Services** window. Here is an example of the **Services** window in *Windows*. This is located in **Control Panel > Administrative Tools > Services.**


Services
File Action View Help
Services (Local)
Name Description Status Startup Type Log On As
QoS RSVP Provides network signaling and local traffic control setup functionality for QoS-a... Manual Local System
Remote Access Auto Connection Manager Creates a connection to a remote network whenever a program references a re... Manual Local System
Remote Access Connection Manager Creates a network connection. Started Manual Local System
Remote Desktop Help Session Manager Manages and controls Remote Assistance. If this service is stopped, Remote Ass... Manual Local System
Remote Procedure Call (RPC) Provides the endpoint mapper and other miscellaneous RPC services. Started Automatic Network S...
Remote Procedure Call (RPC) Locator Manages the RPC name service database. Manual Network S...
Remote Registry Enables remote users to modify registry settings on this computer. If this service... Started Automatic Local Service
Removable Storage Manual Local System
RingMaster Services RingMaster Services Started Automatic Local System
Routing and Remote Access Offers routing services to businesses in local area and wide area network enviro... Disabled Local System
Roxio UPnP Renderer 9 Manual Local System
Roxio Upnp Server 9 Automatic Local System
RoxMediaDB9 Roxio RoxMediaDB9 Service Manual Local System
SavRoam Symantec AntiVirus Roaming Service Started Automatic Local System
Secondary Logon Enables starting processes under alternate credentials. If this service is stopped... Started Automatic Local System
Security Accounts Manager Stores security information for local user accounts. Started Automatic Local System
Security Center Monitors system security settings and configurations. Automatic Local System
Server Supports file, print, and named-pipe sharing over the network for this computer.... Started Automatic Local System
Shell Hardware Detection Provides notifications for AutoPlay hardware events. Started Automatic Local System
Smart Card Manages access to smart cards read by this computer. If this service is stopped,... Manual Local Service
Extended Standard

2. Scroll down and select *RingMaster Services*.
3. Select the **Start** or **Stop** item in the **Action** menu item.
4. Close the **Services** window.
5. Within *RingMaster*, enable it to access the service. (See **Connecting a Client to RingMaster Services**.)

Linux Systems

To start *RingMaster Services* manually on a *Linux* system, as the root user, type:

```
prompt# rm-services start
```

To stop *RingMaster* Services manually, type:

```
prompt# rm-services stop
```

These examples assume *RingMaster Services* are installed in the default location.

Macintosh Systems

To start *RingMaster Services* manually on a *Macintosh* system, open a *Terminal* window, either by using the shortcut on the dock, or by browsing to **/Applications/Utilities** and launching *Terminal* from there. In the *Terminal* window, change to the **bin** directory in the *RingMaster* installation directory. By default, this is **/Applications/RingMaster/bin**.

For example:

```
# cd /Applications/RingMaster/bin
```

To start *RingMaster Services*, enter:

```
# sudo ./rm-services start
```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Enter the password, if prompted.

To stop or restart *RingMaster Services*, enter:

```
# sudo ./rm-services stop
# sudo ./rm-services restart
```

Either of these commands may require you to enter a password. These examples assume that *RingMaster Services* is installed in the default location.

Configuring a Daemon on SUSE 9.1

To add services to a SUSE 9.1 installation, use the **insserv** command.

Enter the following commands (as **root**):

```
suse# cd /etc/init.d
suse# ln -s /opt/ringmaster/bin/rm-services rm-services
suse# insserv rm-services
```

Configuring a Daemon on Red Hat WS 3

To add services to a Red Hat WS 3 system, use the *chkconfig* command.

Enter the following (as root):

```
redhat# cd /etc/init.d
redhat# ln -s /opt/ringmaster/bin/rm-services rm-services
redhat# chkconfig --add rm-services
```

Connecting a Client to RingMaster Services

If a firewall is enabled on the host where you install *RingMaster Services*, *RingMaster Services* will not be able to communicate with *RingMaster Clients* or with WLCs unless the firewall is configured to allow through traffic for the SSL and SNMP ports (443 and 162 by default).

To connect to *RingMaster Services*:

1. Start *RingMaster Client*. Do one of the following:
   a. On *Windows* systems, select **Start > Programs > Trapeze Networks > RingMaster > RingMaster**, or double-click the *RingMaster* icon on the desktop.
   b. On *Linux* systems, change directories to **RingMaster_installation_directory/bin**, and enter **./ringmaster**.
   c. On *Macintosh* systems, select **Finder > Applications > RingMaster**, or click the *RingMaster* icon in the dock.

The **RingMaster Services Connection** dialog is displayed.

2. Enter the **IP address** or fully-qualified hostname of the server on which the service is installed (if not pre-filled). If the service is installed on the same server as the one you are using to run *RingMaster*, enter **127.0.0.1** as the IP address. This is a standard IP loopback address.

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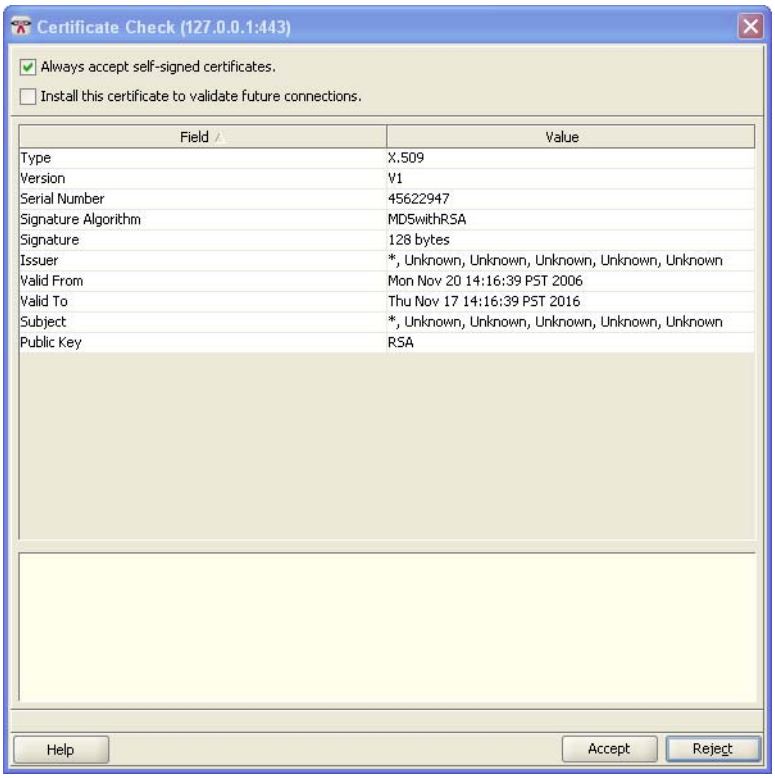
3. Specify the service port, if different from the port number in the **Port** selector list.

> The port number used by *RingMaster Services* must not be used by another application on the server where *RingMaster Services* is installed. If the port number is used by another application, change the port number on *RingMaster Services*. (See **Setup Tab**.)

4. Enter a username and password, if required for access to the service. Usernames and passwords for accessing *RingMaster Services* are configured on the Service Settings tab. (See **Setup Tab**.)
5. To configure *RingMaster Client* to remember the username and password for *RingMaster Service* access, select **Remember user name and password.**
6. If the **Certificate Check** dialog is displayed, click **Accept**.



(For more certificate options, see **Certificate Check**.) If the **Finish** button does not become available, read the last message in the **Open Progress** message area of the page to determine why the service could not be reached. Here are common error messages and suggestions for troubleshooting them:

- **Unable to connect to address: ip-addr:tcp-port-number**— Verify that the service is running on the server.
- **Connection error for address: ip-addr:tcp-port-number** — Verify that the service has been started. If the service is running, verify that the certificate on the server is still valid (for example, is not out of date).
- **HTTP 403: Forbidden** — This message can indicate that the username and password are invalid. Ask the administrator for a username and password.

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Certificate Check

If a **License** message appears, go to “Licensing” in the publication *RingMaster Planning Guide*.

When the *RingMaster Client* connects to *RingMaster Services*, it checks the certificate presented by *RingMaster Services* to verify the certificate’s validity. The certificate is in a key store file on the server. The default key store file is **.rmservices_keystore**. This file contains a self-signed certificate for *RingMaster Services*. You can use this certificate or you can configure services to use a different key store file containing a different certificate. (See **Setup Tab**.) By default, the *RingMaster Client* does not accept self-signed certificates, even from *RingMaster Services*. Instead, when *RingMaster Services* or another device presents a self-signed certificate to the *RingMaster Client*, the **Certificate Check** dialog box appears on the client and displays the certificate information.

Options you select in this dialog box apply to all HTTPS connections with a *RingMaster Client*. For example, the *RingMaster Client* also checks the validity of certificates presented by WLCs, and the settings you select in this dialog affect those connections too.

To complete the connection:

1. Select one or both of the following options, within 60 seconds after the **Certificate Check** dialog is displayed:
   - **Always accept self-signed certificates —** Use this option to configure the RingMaster Client to always accept a self-signed certificate from the RingMaster monitoring service and from WLCs.
   - **Install this certificate to validate future connections —** Use this option to accept the certificate and consider the certificate to be valid for future connections.

When you use this option, the **Certificate Check** dialog box is not shown again for the certificate, even if the certificate becomes out of date.

2. Click **Accept**. To reject the certificate and refuse the connection, click **Reject**. *RingMaster* ends the connection.

If none of the checkboxes in Step 1 are checked, the **Certificate Check** dialog box is re-displayed each time the *RingMaster Client* attempts to establish a connection with *RingMaster Services*.

3. A dialog is shown briefly as a *RingMaster Services* connection is established. Click **Finish**.

RingMaster Services Home Page

To change server settings:

1. Select **Services > Setup**. A browser window opens, displaying the **RingMaster Services Setup** page displayed. The window above shows you information on the *RingMaster Server* and its performance, allows you to Launch a *Web Start Client*, and provides status regarding **Users** on the server.

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2. You can click on the tabs for **Setup**, **Plan Management**, **Reports** and **Maintenance**. Each of these is described in paragraphs below.

Web Start Client

If you click **Launch Client**, a *RingMaster Web Start Client* is installed on your workstation. If this fails, click on the link provided to install *JRE 6.0*.

You then see the *RingMaster Services* connection dialog shown below:

Select or enter the address of the *RingMaster Server* you wish to connect to and continue normally.

Setup Tab

Server Settings

Service settings control connection parameters, key store information, and access control to *RingMaster Services*.

To change server settings:

1. Select **Services > Setup**. A browser window opens, displaying the **RingMaster Services Setup** page with the **Server Settings** page displayed. You can also click on the **Setup** tab in the **Home** page.

The port numbers used by *RingMaster Services* must not be used by other applications on the server where *RingMaster Services* is installed. If port 443 or 162 is used by another application, change the port number for *RingMaster Services* or for the other application.
You can only access this page to change *RingMaster* port 443 if it was able to get this port. If another application is running, *RingMaster Services* cannot display this web page.
services-conf.xml must be edited manually or you must call TAC.

2. To change the TCP port on which *RingMaster Services* listens for requests from *RingMaster*, type or select the port number in the **HTTPS Server Port** field.
   The default is 443.

When you click **Save**, all instances of the *RingMaster Client* lose connection with the service and must re-connect on the new port number. The HTTPS port number is automatically updated for the *RingMaster Client* and connection is restored. Other clients must use the **Monitor Service Select** wizard to change the service port and reconnect.

3. To enable *RingMaster* to re-use an WLC configuration to replace an old WLC with a new one, select **Auto-Config IP Subnet Matching**. (For more information about this option, see “Replacing an WLC and Reusing the Configuration” in the publication *RingMaster Configuration Guide*.)
4. The change the UDP port on which *RingMaster Services* listens for SNMP traps, type or select the port number in the **Trap Receiver Port** field. The default is 162.
5. You can add a Message of the Day (MOTD) to RingMaster that is viewed whenever you log into RingMaster. You can also enable or disable displaying the MOTD.
6. To enable *RingMaster Services* to receive traps via e-mail, you can configure a SMTP Server. Enter the domain name for the server, and the port number. The defalut port number is 25.

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7. To add security to the SMTP Server, enter a username and password. Select Use Authentication.

Server Certificate

Select **Server Certificate** from the **Setup** browser window and view server certificates.

You can generate an SSL certificate to replace the default server certificate. Before you create a new certificate, you can view the default certificate using your Web browser.

1. To create an SSL X.509 certificate, click Create to begin the process.
2. To change the name of the key store file that contains the encryption keys *RingMaster Services* uses for authentication with *RingMaster*, edit the name in the **File** field. The default name is .**rmservices_keystore**.

Caution must be used when editing this. If a change is unsuccessful, you will not be able to start *RingMaster Services*. You will have to call TAC.

3. To change the password that protects access to the key store file, edit the value in the **Password** field.
4. To specify the file type for the key store file, select one of the following:
   - **PKCS12** — Public-Key Cryptography Standard number 12.
   - **JKS** — Java Key Store, a format used by Java platforms and applications.

Location Server Key Store and Certificate

You can allow RingMaster to accept all certificates by enabling Accept All Certificates. And you can allow RingMaster to accept Self-Signed Certificates by enabling Accept Self Signed Certificates.

Licensing

Select **Services** > **Licensing** from the *RingMaster* main menu bar to open a browser window and view product licensing information, or to access RingMaster product licensing server Web page.

This window shows you existing license status and allows you to enter new serial numbers and license keys as needed.

You need a valid base license before adding additional licenses

Ringmaster has several licensing levels (SKU):

- **EVAL** — Evaluation license is valid for 90 days and enables support for up to 50 APs, unlimited switches, and planning.
- **RMTS** — Base license enables support for up to 5 APs and one switch (must be installed first before installing other RMTS licenses like the RMTS-50, RMTS-100, RMTS-500 and RMTS-PLAN).
- **RMTS-10** — Enables support for up to 10 additional APs.
- **RMTS-50** — Enables support for up to 50 additional APs.
- **RMTS-100** — Enables support for up to 100 additional APs.

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- **RMTS-250** — Enables support for up to 100 additional APs.
- **RMTS-500** — Enables support for up to 500 additional APs.
- **RMTS-1000** — Enables support for up to 1000 additional APs.
- **RMTS-PLAN** — Enables planning.
- **RMTS-AGENT** — Enables RM Agent.
- **RMTS-ADV-Monitor** — Enables advanced monitoring features such as Spectrum Analysis.
- **RMTS-SECURITY-ADV —** Enables you to add an AirTight Server to your configuration.
- **RMTS-EVAL-AGENT** — Evaluate the RM Agent feature for 90 days.
- **RMTS-EVAL-LOCATION** — Add a WLM-1200-LA for location applications.
- **RMTS-EVAL-MONITORING-ADV** — Evaluate advanced monitoring features for 90 days.
- **RMTS-EVAL-SECURITY-ADV** — Evaluate advanced security features for 90 days.

WLC Connection Settings

WLC connection settings control timeout and retry intervals for connections with monitored WLCs, and the types of certificates the service accepts from WLCs.

To change WLC connection settings:

1. Select **Services > Setup** or select the browser window if *RingMaster Services* is open.
2. Select **Setup**, then select **MX Connection Settings**.
    a. To change the number of seconds *RingMaster Services* waits for a TCP connection with an WLC to reach the Connect stage, type or select the value in the **Connect Timeout** field. You can specify from 1 to 30 seconds. The default is 5 seconds.
    b. To change the number of times *RingMaster Services* attempts to query an WLC, if *RingMaster Services* does not receive a reply to the first query attempt within the connect timeout, type or select the value in the **Connect Retries** field. You can specify from 0 to 5 retries. The default is 3 retries.
    c. To configure the default response timeout, enter a value in seconds. The default time is 60 seconds.
    d. To save the MX configuration after deploying it through RingMaster, select **Save Configuration on Deploy**.
    e. To prevent *RingMaster Services* from accepting all types of certificates from the WLCs it monitors, click **Accept all certificates** to disable the option. By default, *RingMaster Services* accepts certificates from WLCs regardless of whether they are generated by a certificate authority (CA) or they are self-signed certificates. When you disable this option, the **Accept self-signed certificates** option remains enabled.
    f. To prevent *RingMaster Services* from accepting self-signed certificates from the WLCs it monitors, click **Accept Self-signed certificates** to disable the option. When both the **Accept all certificates** and **Accept Self-signed certificates** options are disabled, *RingMaster Services* accepts only CA generated certificates.
    g. To specify a key store filename and a password to protect access to that file:

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- Enter the filename in the File field.
- To change the file type for the key store file, select one of the following in the Type pull-down:
- PKCS12 — Public-Key Cryptography Standard number 12, the standard format used by Linux machines.
- JKS — Java Key Store, a format used by Java platforms and applications.
- Enter the password in the Password field. When both the Accept all certificates and Accept self-signed certificates options are disabled, and you specify a key store file, RingMaster Services accepts a certificate from an WLC only if the public key information for that certificate is in the key store file.

3. Click **Save** to save the changes.

Monitoring Settings

By default, status monitoring and monitoring of WLC notifications is enabled. Status monitoring supplies data for the Explore and Status Summary windows of the Monitor tab. SNMP notifications (traps) generated by WLCs supply data for the **Client Monitor**, **RF Monitor**, and **RF Trends** windows. **Table 1– 1** lists the source of the data for each window in the Monitor button and for the **Performance Statistics** window.

RingMaster Client Display	Data Source	Default
Monitor — Status Summary	Status monitoring of WLCs by RingMaster Services	Enabled
Monitor — Clients	Enable Client Session Collection option	Enabled
Monitor — Traffic	Radio and Port statistics.	Enabled
Monitor — High Utilization, RF Interference, and Coverage Hole	Enable Traffic & RF Trending option and configure RF Threshold Settings	Enabled
Alarms	Input from all polls	Enabled

The monitoring options require SNMP traps to be enabled on the monitored WLCs and also require *RingMaster Services* to be configured as a notification target (trap receiver) for each of the WLCs.

The data for some reports also requires monitoring options to be enabled. For information, see descriptions for each report inRingMaster Reports,” .

To change monitoring settings:

1. Select **Services > Setup** or select the browser window if *RingMaster Services* is already open.
2. Select **Setup**, then select **Monitoring Settings**.
   - To change **Polling Options**, use click boxes to enable features and enter values you want for enabled items, including:

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- **Auto-Adjust Poll Intervals —** By default, **Auto-Adjust Poll Interval** is selected. If the server detects the number of devices exceeding a certain limit, it will automatically adjust the poll interval for all to a higher value. You will not be able to set a poll interval lower than the recommended setting. If Auto-Adjust Poll Interval is not selected, you can change the poll interval to any value between 5 and 60 minutes.
- **Status**
- **Client Sessions**
- **Watched Clients**
- **Radio and Port Statistics**
- **Rogue Devices**
- **Configuration Changes**

1. To make choices regarding the **Radio and Port Statistics Database**, make the following selections:
   - **Average Specific Times in Rollup — C**heckbox
   - **Include Days of week and Hours —** This restricts data averaging for reports for higher accuracy within specified hours/days.
2. To change the **RF Threshold Settings**, enter new settings for the following statistics [default settings are indicated in brackets]:
   - **Radio Retransmit Threshold (%) [10]**
   - **Radio Noise Floor Threshold (dBm) [-85]**
   - **Radio Signal Level Threshold (dBm) [-75]**
   - **Utilization Threshold (%) [80]**
   - **SNR Threshold (dBm) [15]**
   - **Number of Clients per Radio [15]**

   You can click **Reset Threshold Settings** to revert to default values.
3. Click **Save** to save changes.

SNMP Notification

SNMP traps that the *RingMaster Server* can generate are sent to receivers configured in the RM Web page.

To set up SNMP notifications:

1. Select **Services > Setup** or select the browser window if *RingMaster Services* is already open.
2. Select **Setup**, then select **SNMP Notification**.
3. Enter a **Target IP**, accept or change the **Port** aned **Community** entries and select a version of SNMP from the **Version** list. Use check boxes to determine **Category** and **Severity** filter settings and then click **Add**.

   SNMP Targets are displayed.

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Audit Trail

You can configure RingMaster to track activity using an Audit Trail. To configure Audit Trail, use the following steps:

1. Click Setup>Audit Trail to display the configuration options.
2. To configure Local Auditing, select Enable Local Auditing.
3. To enable detailed audit trails, select Full Detail Local Auditing.
4. The log files are configured to purge from RingMaster every 30 days. To change the purge interval, enter the number of days before purging in the Automatic Purge Interval (days) field.
5. Click Purge All to remove all of the log files.

To configure auditing on a RADIUS Server, use the following steps:

1. Select Enable RADIUS Auditing.
2. To enable detailed audit trails, select Full Detail Local Auditing.
3. To configure the RADIUS Server, enter the following information:
   - **IP Address**
   - **Shared Secret**
   - **Accounting Port**
   - **Maximum Packet Size (bytes) —** the default size is 4096 bytes.
   - **Timeout (s) —** The default value is 5.
   - **Retry Count —** The default value is 2.
4. Click Save to store the configuration for RingMaster.

Access Control Tab

You can create a user account with privileges either as a full **Administrator**, allow users to have **Provision** capabilities, or allow them only **Monitor** privileges. See **Table 1– 2** for privilege definitions. .

You must add a user first if none are defined before enabling access control.

Privilege Level	Access Control	Configuration	Monitoring
Administrator	yes	yes	yes
Provision	no	yes	yes
Monitor	no	no	yes

To change **Access Control** settings:

1. Select **Services > Setup** or select the browser window if *RingMaster Services* is open.

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2. Select **Setup**, then select **Access Control**.

To configure access control:

3. Select **Services > Setup** from the *RingMaster* menu bar. *RingMaster Services* is displayed in your default Web browser**.**
4. Select **Access Control**.
5. Click **Enable login-required**. Enter a username and password for administrative access. Click **OK**. (You must configure an admin account before you can configure provisioning or monitoring users.)
6. Enter the name under the **Add User** section.
7. Select **Administrator**, **Provisioning User**, or **Monitoring User** form the **Role** list.
8. Enter the password. Re-enter the password.
9. Click **Save**. The new account appears in the Authorized Users section.

The **RingMaster Services Home Page** lists authorized users, associated roles, and connection status/times.

10. To remove an account, click **Delete** next to the desired account.
11. To reset a password, click **Edit**.

User Groups

User Groups are created in the **Add User Group** section of the **Setup > Access Control** page for configuring view restriction rules for Monitoring Users. View restriction rules are configured only for the current plan. These rules are not applied when switching to a different plan.

The following new fields are added to the **Add User** section of the **Setup Access Control** page as well as the **Edit User Info** popup window.

These fields are enabled when **Monitoring Users** are specified:

- Restrict View
- Scope Type — allows a user to select a restriction scope type.
- Scope Instance — displays all the related instances of the selected scope type.

RADIUS Servers

RADIUS authentication is enabled from the **Access Control > RADIUS Servers** page.

User Locking

You can define the number of unsuccessful login attempts before locking a user out of the system. The default value is 3.

The Locking Period determines the amount of time that a user is locked out of the system before allowing the user to attempt the login process again. The default value is 3 minutes.

Locked Users are displayed in a table. Select a user and clear the lock.

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Plan Management Tab

Creating a New Plan

To set up a new network plan:

1. Select **Services > Setup** or select the browser window if *RingMaster Services* is already open.
2. Select **Plan Management**, then select **New Plan**.
3. Enter a new **Network Plan Name**, select a **Country Code**, select **Open This Plan?** and click **Create.**

Switching From One Plan to Another Plan

To switch network plans:

1. Select **Services > Setup** or select the browser window if *RingMaster Services* is already open.
2. Select **Plan Management**, then select **Switch Plan**.
3. Selecte the plan to open and select **Switch**.
4. A message is displayed indicating that the plan has changed:
5. Click **Close**.
6. You must re-connect to continue.
7. The new plan is now open.

Deleting Network Plans

To delete network plans:

1. Select **Services > Setup** or select the browser window if *RingMaster Services* is already open.
2. Select **Plan Management**, then select **Delete Plans**.
3. Click the check boxes beside plans you wish to delete and select **Delete**.

Importing Network Plans

To import network plans:

1. Select **Services > Setup** or select the browser window if *RingMaster Services* is already open.
2. Select **Plan Management**, then select **Import Plan**.
3. Select the plan you wish to import from the available plans.

Saving Plans As New Plans

To save network plans with a different name:

1. Select **Services > Setup** or select the browser window if *RingMaster Services* is already open.
2. Select **Plan Management**, then select **Save As**.
3. Enter a new plan name and click **Save**.

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Backing Up and Restoring Plans

RingMaster Services regularly backs up network plans at configurable intervals. In addition to regular backups, you can create a backup at any time. You can create a backup from within *RingMaster* or at a command line. From within *RingMaster*, you change settings for automatic backups. To manage backups, select **Services > Backup & Restore**. If *RingMaster Services* is already open in the browser window, select **Plan Management**, then select **Backup & Restore**.

Existing backups for network plans are listed. Backups automatically created by *RingMaster* do not have names, and their type is **Automatic**. Backups you create have names, and are labeled as **Manual**. Only backups for the currently open plan are listed. By default, backups created automatically by *RingMaster* are stored in the following location:

`RingMaster\backup\auto\`*`plan_name`*

Backups created by you are stored in the following location by default:

`RingMaster\backup\manual\`*`plan_name`*

RingMaster zips backup files and assigns them unique names. You can assign a name to a backup that you create. However, this name does not appear in the backup directory. To select a plan based on a name you assign, use the **Backup/Restore** dialog.

Backing Up a Plan

To immediately create a backup:

1. Select **Services > Backup & Restore**. If *RingMaster Services* is already open in the browser window, select **Plan Management**, then select **Backup & Restore**.
2. Type a name for the backup in the **Backup Name** field.
3. Click **Create Backup**. When the backup is complete, it appears in the list of backups. (If you do not see the backup, scroll to the bottom of the list.)

Changing Backup Settings

To change settings for automatic backups:

1. Select **Services > Backup & Restore**. If *RingMaster Services* is already open in the browser window, select **Plan Management**, then select **Backup & Restore**.
2. To change how often *RingMaster* automatically backs up network plans, select **Hourly** or **Daily** from the **Backup Interval** pull-down list.
3. If you select **Daily**, specify the time to create the backup.
4. To change the maximum number of backup copies RingMaster will keep for a plan, change the number in the **Number of backup copies** field. Click **Save**.

Restoring a Plan from a Backup

To restore a plan from a backup:

1. Select **Services > Backup & Restore**. If *RingMaster Services* is already open in the browser window, select **Plan Management**, then select **Backup & Restore**.
2. Select the backup you want to restore. Click **Restore**.

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Copying a Plan Backup from One Server to Another

Copy a plan to another server by copying the backup file for that plan to the other server, and then restoring the plan on the other server from the backup.

To copy a network plan backup from one server to another:

1. Select **Services > Backup & Restore**. If *RingMaster Services* is already open in the browser window, select **Plan Management**, then select **Backup & Restore**.
2. Select the backup you want to restore. Click **Transfer**. The **Transfer Backup** dialog appears.
3. Type the IP address of the host where another instance of **RingMaster Services** is installed.

RingMaster Services must be running on the host where you want the backup transferred to.

4. If the port on which the other instance of *RingMaster Services* listens for traffic from RingMaster is different from the default, edit the number in the **Service Port** field to match.
5. Type the username and password required by the other instance of *RingMaster Services*. Click **Transfer**.
6. On the server to which you copied the backup, access the **Backup/Restore** page.
7. Select the backup and click **Restore**.

Deleting a Plan Backup

To delete a plan backup:

1. Select **Services > Backup & Restore**. If *RingMaster Services* is already open in the browser window, select **Plan Management**, then select **Backup & Restore**.
2. Select the backup and click **Delete**.

For more information on network plans, refer to the publication *RingMaster Planning Guide*.

Reports Tab

This tab allows you to view, with and without filtering, and to delete reports.

The **Filter by report type** list provides items by which reports can be filtered:

- All
- AP Availablity
- AP Availability Details
- Audit Trail
- Call Details
- Call Summary
- RF Summary
- Degraded Network Link
- Inventory
- Low Power PoE
- MX Configuration
- Mobility Domain Configuration

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- AP Inventory
- Mobile Domain Configuration
- Client Summary
- Client Details
- Client Errors
- Client Load by AP
- Client OUI
- Wireless Network Usage (Radio Traffic)
- Wireless Network Usage (Port Traffic)
- SmartPass Accounting Details
- SmartPass SMS and E-mail Notification
- Radio Details
- Rogue Details
- Rogue Summary
- Alarm Summary
- Alarm History
- PCI Compliance
- Site Survey
- Security Alarms
- Top APs
- SmartPass Accounting Summary
- Work Order

Select reports using radio buttons adjacent report entries. There is a **Reload** button provided.

Maintenance Tab

Maintenance pages let you perform system clean up of databases and other items on the server.

Memory

To access memory settings:

1. Select **Services > Setup**, if *RingMaster Services* is not displayed in a browser window.
2. Select **Maintenance**, then select **Memory**.

This screen shows Server Memory **Used**, **Allocated**, and **Maximum**, and provides a button to force Java memory recovery.

Database

Under Database, the following information is displayed:

Configuration

- Plan Name
- Base XML
- ChangeSet XML
- Journal
- Graphs Folder
- Objects Folder

Monitoring

Total file size for monitoring logs

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Alarms

Select **Maintenance**, then select **Alarms**.

Server Performance Alarms and **Alarm Statistics** are displayed for the server.

Device Requests Statistics

Select **Maintenance**, then select **Device Requests Statistics**. This is used to assist TAC in troubleshooting *RingMaster* server performance problems

This page provides information on server threads, queues, executing and completed items, etc.

Current Log

Select **Maintenance**, then select **Current Log**. TAC may ask you to set a log level for debugging, and then run a report or send the log folder to troubleshoot problems.

This window allows you to review the log, and to set filtering and logging values. You can view specific error types by using the pull-down menu shown in the example window above.

Log History

Under Log History, you can see the following information:

Settings

- Maximum Number of Log Files
- Maximum Size of a Log File (MB)

Log Files

Log Files are displayed in a table with the following information:

- Name
- Path
- Date Last Modified
- View

Lock Management

Select **Maintenance**, then select **Lock Management**.

Threads

Select **Maintenance**, then select **Threads**.

This screen contains trouble shooting/debugging information on server threads that may be useful in working with TAC on any server problems you may encounter.

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RingMaster Preferences

This chapter describes how to change *RingMaster* preferences. You can set *RingMaster* preferences for a user session on the system on which *RingMaster* is installed. The preferences you set are valid only for that user on that system. Initial setting of *RingMaster* preferences is described in detail in “Setting Preferences” in the publication *RingMaster Planning Guide*.

Preferences Values

To set or change *RingMaster* preferences, in the *RingMaster* main window, select **Tools > Preferences** and you will see a multi-tabbed **Preferences** dialog. Settings made with items on each of these tabs are described in the paragraphs below.

Network Options

To change network options:

1. Select **Tools > Preferences**. The **Preferences** dialog box appears.
2. Click the **Network** tab.

You can access these same settings as described above in **WLC Connection Settings**.

3. To set the amount of time that *RingMaster* waits for a connection to be established to an WLC before trying to connect again, specify the timeout (1 to 30 seconds) in the Connect Timeout box. The default is 5 seconds.
4. To set the number of times (0 to 5) *RingMaster* tries to reconnect to the WLC after the original attempt, specify the value in the **Retry Count** field. The default is 3 times. For example, if the retry count is 3, *RingMaster* attempts to establish a connection to an WLC four times. If you specify 0, *RingMaster* does not attempt to establish a connection if the first attempt is unsuccessful.
5. Default Timeout Response (seconds) can be configured as the length of time to wait for a response from a WLC.
6. Select FIPS to configure RingMaster for FIPS requirements.

If you are accessing RingMaster using the Java Webstart Client, the FIPS option is not displayed.

7. Click **Close** to close the **Preferences** dialog box, or click another tab to continue making changes.

Tools Options

You can change the Telnet and Web browser applications that start from the *RingMaster* Tools menu. The default Telnet application is Microsoft Telnet Client. The default Web browser is Microsoft Internet Explorer. For SSH and Wireshark, you must configure RingMaster with the location of executable file.

To change tools options:

1. Select **Tools > Preferences**. The **Preferences** dialog box appears.
2. Click the **Tools** tab.
3. To change the Telnet executable file or location used by *RingMaster*, type the path of the executable file in the **Telnet Executable** field. For Windows systems, the default Telnet executable file is **C:\WINDOWS\system32\telnet.exe**. For *Linux* systems, the default is **/usr/bin/telnet**. For Macintosh systems, the default is **bin/sh telnet**. You can also click **Browse** to navigate a computer filesystem.
4. To change the Web browser executable file or location used by *RingMaster*, type the path of the executable file in the **Browser Executable** field. For Windows systems, the default Web browser executable file is **C:\Program Files\Internet Explorer\iexplore.exe**. For *Linux* systems, the default is **/usr/bin/mozilla**. For Macintosh systems, the default is open. You can also click **Browse** to navigate a computer filesystem.
5. Click **Close** to close the **Preferences** dialog box, or click another tab to make more changes.

RF Options

You can change the following RF planning options:

- Typical transmit power for clients in the Trapeze network.
- Color schemes for showing RF information

To change the transmit power of a typical client:

1. Select **Tools > Preferences**. The **Preferences** dialog box appears.
    1. Click the **RF** tab.
2. In the **Typical Client Tx Power (dBm)** field, specify the typical transmit power (1 to 20 dBm) for clients in the network. The default is 13 dBm, a common client transmit power. If you want to choose a color for an RF technology or obstacle, see Changing Colors.

Selecting Colors

You can select color schemes by selecting tabs for the following types of RF information:

- **802.11a Channel Colors**
- **802.11b/g Channel Colors**
- **RF Obstacle Colors**
- **Data Rate Colors**
- **RSSI Band Colors** (Receive Signal Strength Indicator)
- **SNR Band Colors** (Signal-to-noise ratio)
- **Load Band Colors** (number of clients associated with a radio)

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- **Probability Colors** (of a rogue device or client being in a specific location)
- **Mesh Colors**

For each scheme, you change a color using any of the following methods:

1. Select a color from a predefined palette. If you click on a color, the **Choose Color** dialog box appears.
   a. To specify a color using the color palette, click Swatches in the dialog box.
   b. From the color palette, click the color you want to see. Repeat until you find the color you want. In the Preview box, you can see the swatches and text in the color you chose. The Recent box shows the colors you have chosen so far. Click Reset to choose the original pre-defined color and clear the Recent field.
   c. Click OK to accept colors you chose. The RF tab in the Preferences dialog box is active.
   d. Do one of the following:
      - Change another color.
      - Click another Preferences tab.
      - Click Close to close the Preferences dialog box.
2. Define a Color by Changing HSB Properties. You can define colors by changing the hue, saturation, and brightness (HSB).
   - Hue is the color itself (for example, blue, orange, or purple). Hue is measured in degrees (0 to 360 degrees).
   - Saturation is the strength of the color. Saturation values are measured in percentages, with 0 percent indicating no color saturation (gray) and 100 percent indicating full saturation.
   - Brightness is the amount of light in the color. Brightness is also measured in percentages, with 0 percent indicating black and 100 percent indicating white.
3. To specify a color by changing HSB:
   a. Click HSB in the Choose Color dialog box.
   b. To change a hue value, click the H radio button and do one of the following.
   c. In the H field, specify a value between 0 and 360 degrees.
   d. Use the slider to specify the hue value.
   e. The color appears in the **Preview** field. You can also see the RGB equivalent in the **R, G**, and **B** fields next to the slider.
   f. To change the saturation value, click the S radio button and do one of the following:
      - Use sliders to specify color values.
      - In the S selector box, specify a value between 0 and 100 percent.
   g. To change the brightness value, click the B radio button and do one of the following
      - In the B selector box, specify a value between 0 and 100 percent.
      - Use the slider to specify a brightness value.:
   h. Click OK to accept a color.

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4. You can define a color by changing Red, Green, and Blue (RGB) color properties. To specify a color by changing RGB:
   a. Click RGB in the Choose Color dialog box.
   b. Use the Red, Green, and Blue sliders to define a color. You can see a preview of the color in the Preview field.
   c. Click OK to accept a color.

Logging Options

You can change the severity and type of *RingMaster* events logged. By default, event logging level is set to **Critical**, and all events are logged.

To change *RingMaster* logging options:

1. Select **Tools > Preferences**.
2. Click the **Logging** tab.
3. In the **Log Event Level** pull-down, select one of the following event levels:
   - **Critical** — A critical condition has occurred that requires immediate resolution.
   - **Warning** — An event that might require attention has occurred.
   - **Info** — Informational messages only. No action is required.
   - **Debug** — All events are shown, including debug messages.

Select the **Debug** option only if the Trapeze Networks TAC has advised you to do so. Debug-level logging (changed only on this client) significantly impacts network performance and should only be enabled temporarily to troubleshoot problems, as directed by TAC.

4. There are check boxes that allow you to select items to be saved in reports generated by *RingMaster*. This includes the following:

- Log General Events
- Log UI Infrastructure Events
- Log Persistence Events
- Log UI Events
- Log Network Events
- Log Service Events
- Log Model Events
- Log Device Interface Events
- Log Mapper Events
- Log Transaction Manager Events
- Log Syslog Manager Events
- Log RDBMS Events

5. There are **Reset** and **Reset All** buttons to cancel changes or revert to default settings.
6. Click **Close** to close the dialog box, or click another tab to continue making changes.

Certificate Management

By default, *RingMaster* does not accept self-signed certificates from WLCs or from the monitoring service. You can change this option in the **Preferences** dialog box. (For more information about certificate handling, see **Certificate Check**.

To change certificate management options:

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1. Select **Tools > Certificates**. The **Certificate Management** dialog box appears.
2. To automatically accept self-signed certificates, click to check the **Always accept self-signed certificates** checkbox. To clear this option, clear **Always accept self-signed certificates** checkbox. By default, this option is disabled. The *RingMaster Client* accepts a certificate only if it is signed by a Certificate Authority (CA). You see a list of certificates in use and have buttons to see **Details** and to **Delete**.
3. Click **Close** to close the **Certificate Management** dialog box, or click another tab to continue making changes.

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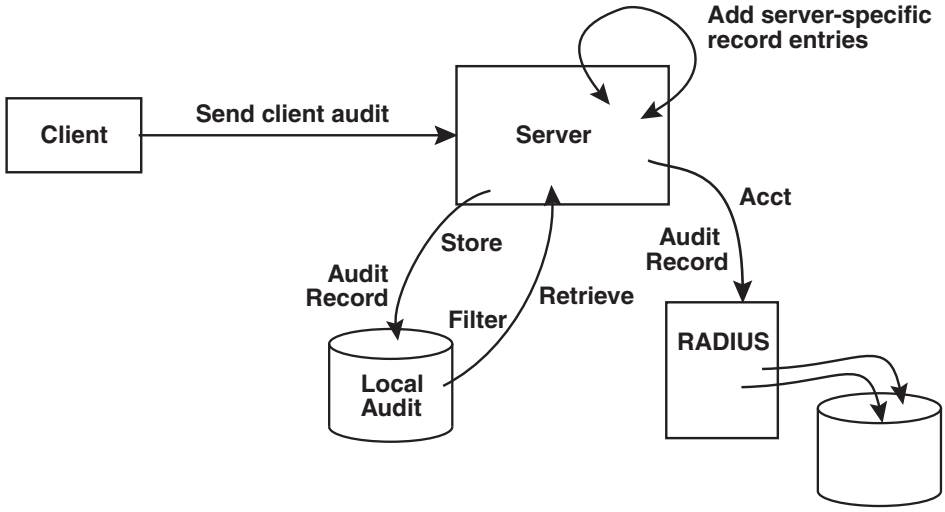
Managing with RingMaster

This chapter provides information on deploying services — enabling services for wireless clients on a network. It also provides information about configuring WLC management services and performing administrative tasks. For detailed information on performing administrative tasks on an WLC, refer to “Configuring WLC System Parameters” in the publication *RingMaster Configuration Guide*.

Audit Trail

RingMaster Server software receives and stores audit records in an internal or external database. If a client sends a specific audit record to the server, the server extends an audit record with other information (session details, the system time, etc.) and stores the record in a database. Before storing records, the server adapts audit records based on their database format. The server retrieves audit entries from the database using a filter, then it sends these audit entries to a client to display them. A simple diagram for this flow is shown below:



Operations Tracked

Operations tracked in audit files include the following:

- Client actions that send a change set to the server
- Client actions that do not send a change to the server, and
- Server actions

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Client Actions Sent to Server

Client actions that send a Change Set to the server include one or more of the following:

- Finishing a Wizard (in **RF Planning**, **Policy**, **Configuration**, **Verification**, or **Alarm** views)
- Finishing a **Properties** dialog
- Pressing the **Save** button in the main window
- Deleting an object using a wizard or by pressing the **Delete** button in a form
- Perform a **Copy & Paste**
- **Uploading** an WLC / **Creating** an WLC / **Deleting** an WLC
- Creating/Modifying/Deleting a **Policy**
- **Uploading** or **Creating** an WLC with an existing policy

Client Actions Not Sent to Server

Client actions that do *not* send a Change Set to the server include one or more of the following:

- Deploying
- Image Installation
- Accepting Network changes
- Undoing Local Changes
- Undoing Network Changes
- Applying a Policy
- Scheduling a Deploy
- Scheduling an Image Upgrade
- Managing / Unmanaging a device

Server Actions

Server actions that send a Change Set to the server include one or more of the following:

- Server Deployment
- Server Image Installation
- Merging object cache / Finishing a transaction
- Performing XML transactions (**SET**, **DELETE**, **ACTION**)

User Entries

The user audit entry stores information about user names and roles (e.g. administrator, monitor).

Time and Date Entries

Time and Date audit entries contain information about the time when an operation occurred. They include the time zone by specifying an offset of minutes and hours.

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External Database

RingMaster stores audit records in an external RADIUS server as accounting information. Therefore, *RingMaster* does not need to send accounting messages to a RADIUS server.

Radius Attribute Name	RADIUS Value	Field Value
Acct-Status-Type	40	Always set to STOP value
User-Name	1	The user name
Event-Timestamp	55	Timestamp of the event in UTC format
Calling-Station-Id	31	Ip address of the user
Acct-Session-Id	44	Unique accounting session id for each record
Acct-Multi-Session-Id	50	Unique value for a same user session
NAS-Port	5	TTY port or connection port used
NAS-Port-Type	61	Type of connection
NAS-IP-Address	4	WLC IP address
NAS-Identifier	32	Always set to "Trapeze"
Trapeze-Audit	13	A string VSA containing audit information

Access Control

In the last few releases, *RingMaster's* access control capabilities have improved. This version provides a more generic and flexible mechanism to allow you to set up access controls to meet specific operational needs. This allows you to partition a network according to your specific requirements and define which functions each type of user has authority to access in specific areas of a network.

Refer to the publication *RingMaster Configuration Guide* for details on setting up Access Control for your network.

Data Model

Setting up access control begins by defining a User Group. You are no longer limited to three pre-defined User types — administrator, provisioning user, and monitor user. After creating a user group, privileges for that group can be associated with various sets of objects in a plan. For example, you can assign configuration editing privileges for a specific MobilityDomain and its associated member devices. After associating privileges for a set of objects to a user group, users can be assigned to the group. Assigned users acquire the group's privileges in the plan.

Object Group

An Object Group identifies a set of objects in a plan. Object Groups are defined as part of assigning privileges to a user group. A separate object group is defined for each privilege type assigned to a user group. An object group is bound to the user group for which it was originally created. The set of objects an object group refers to can be referenced by other object groups.

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The following types of objects may be added to an object group:

- **Network Plan**
- **WLC**
- **Mobility Domain**
- **Site**
- **Building**
- **Floor**
- **Location Group**
- **Equipment Group**

Only two objects may be added to an object group. Furthermore, if two objects are choosen, each must be of a different category as shown below (i.e. only one object per category).

- **Location-related objects**
  - **Location group**
  - **Site**
  - **Building**
  - **Floor**
- **Equipment-related objects**
  - **Equipment group**
  - **Mobility Domain**
  - **WLC**

Privileges

The following privileges may be assigned to a user group:

- **Viewing of configuration data**
- **Editing of configuration data**
- **Viewing of monitoring data**
- **Server administration**

User

Users are global entities shared across all plans. Their associations to user groups are maintained across plans. A user can only be assigned to a single user group.

User Privileges

There are changes to user privileges for various views as detailed in the next paragraphs.

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Configuration/RF Planning View

Privileges to view and edit configuration data are assigned to groups of objects in a plan. If a user does not have viewing privileges for an object, that object does not appear in the organizer tree. Configuration viewing privileges do not affect what is displayed in monitoring views. Monitoring is a separate privilege. This allows an administrator to set up users whose primary role is for monitoring only.

Organizer Tree

When a user switches to the configuration view, the root object in the organizer tree is the single object (in the object group) associated with the configuration viewing privilege for that user's assigned user group (as shown in the example screen below).

Object Editing

If a user does not have editing privileges for an object, all tasks involving modifications to that object are unavailable. All configuration data input fields for that object are disabled in the main details panel. In some cases, a user may have editing privileges for an object, but a change causes a modification of some other object that they are not privileged to edit. In this case, the change and all other side effect changes involved in the transaction are rejected. An error message is dosplayed, informing the user of an access control violation.

Configuration Tasks

Available configuration tasks include:

- NetworkPlan
  - Create Mobility Domain
  - Create Mobility Exchange
  - Create Equipment Group
  - Create Third Party AP
  - Country Code
  - Channel Set
  - Disable Auto-Tune
  - Authentication Mode
  - AP Local Switching
  - SmartPass Server
  - Set Up AirDefense
  - Launch AirDefense UI
  - Create AirDefense Sensor
  - Upload WLC
  - Convert Auto AP
  - Remove Auto AP
  - Network Domain
- MobilityDomain

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  - Mobility Exchange
  - Create Equipment Group
  - Setup MX-MX Security
  - AP Signature
  - AP Redundancy
  - Add Members to Cluster
  - Remove Members from Cluster
  - Remove Secondary Seed
  - Delete cluster
  - Upload MX
- MX
  - Review
  - Deploy
  - System Setup
  - Software Version
  - Model
  - Authentication Mode
  - Time
  - System Information
  - Add to Cluster
  - Go to Monitor
  - Go to Verification
  - Go to Alarms
  - Go to RF View
- Third Party APs
  - Create Third Party AP
  - Create Ignore List Entry

Verification View

The **Verification** view displays information on objects for which a user has configuration viewing privileges. Summary counts displayed on the status line at the bottom of the main screen are based on access control-filtered results. Resolutions are disabled if a user does not have editing privileges for an associated object. Verification options setup requires server administration privileges.

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Policy View

Access control for a policy object is derived based on the specific policy's set of associated devices. Users having viewing privileges for at least one of a policy's associated devices will be allowed to view the policy's configuration data. To create, delete, or edit a policy, a user must have edit privileges for the entire plan. This is required because, once a policy is created, it can result in automatic device configuration changes. This can occur whenever a device is created or uploaded. As part of these operations, the system searches for policies that match a device's model and version. The base configuration of these matching policy objects is automatically applied to the new device. To associate a new device with a policy, a user edits the privileges for the device being associated. In order to apply policy changes to member devices, a user must have edit privileges for all of the policy's associated devices. A user will only be allowed to review policy changes for the set of devices for which they have configuration viewing privileges.

Devices View

The set of WLCs displayed in a devices view is based on a user's configuration viewing privileges. The ability to invoke tasks for selected devices may require additional privileges. The table below lists these requirements. The **MX Credentials** column is used to indicate that, in addition to *RingMaster* privileges, the user must also provide a valid username/password for the target WLC. By default, the user's *RingMaster* credentials are used.

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Task	Required Privilege for Device		
	Config. Viewing	Config. Editing	MX Credentials
Review Local Changes	●		
Deploy		●	●
Undo Local Changes		●	
Review Network Changes	●		
Accept Network Changes		●	
Undo Network Changes		●	
Go to Configuration	●		
Go to Verification	●		
Refresh	●		
Upload MX			
View Operations Log	●		
Image Install		●	●
Reboot MX			●
Manage/Unmanage		●	
Distribute Certificates			●
Image Repository		●	

Reports View

Access to certain reports requires configuration data viewing privileges. When generating reports, a user must select a scope. All scope types are available for selection, but object instances for each type are limited to those for which the user has access. A user must have configuration viewing privileges for an object as a whole in order for an object to appear in the selection list. In addition to report generation, access control is enforced for the set of pre-existing reports available for viewing. For each report stored on the server, information is maintained regarding the set of objects represented in the report. If a user attempts to view a pre-existing report, a check is performed to ensure the user has configuration viewing privileges for the complete set of referenced objects.

The reports shown below require configuration data viewing privileges. Access to other reports is based on monitoring privileges.

Report	Available Search Scopes
Inventory	NetworkPlan, MobilityDomain
Mobility Domain Configuration	MobilityDomain
MX Configuration	MX
Site Survey Order, Work Order	NetworkPlan, Site, OutdoorArea ,Building, Floor

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Monitoring Privileges

The ability to view monitoring data for objects in a plan is a separate privilege that must be assigned to a user group explicitly. The privilege to view configuration data does not imply monitoring access. Likewise, monitoring access does not imply the ability to view configuration data.

Organizer Tree

When a user switches to the **Monitoring** view, the root object in the organizer tree is the single object (in the object group) associated with the monitoring viewing privilege for that user's assigned user group. By setting the organizer root node this way, a user always has full monitoring privileges for everything in the tree. This avoids the complexity of calculating access control-filtered monitoring results for nodes in the tree for which the user has only partial access.

Find Clients

The **Find Clients** task is launchable from the client panel in the status summary tab as well as from the **Client Details** monitor tab. When a task is invoked, a dialog appears with the current scope object pre-selected as the initial search criteria. To enforce access control restrictions, the ability to change this search scope to some other object in the plan is removed.

Find RFID Tag

The **Find RFID Tag** task is launchable from the **Client Details** monitor tab. This task is always present, regardless of the organizer tree's current scope selection. The dialog for this task contains controls to search a specific MobilityDomain or a specific device. Similar to the Find Clients task, this dialog allows you to change search criteria to an object different from the current tree selection. To prevent users from invoking searches against devices for which they do not have monitoring privileges, this task is only available in the context of a MobilityDomain or device tree selection. Users are not be allowed to alter pre-selected scope values in the dialog.

Report Tasks

The **Client**, **Traffic**, and **Radio Monitor** tabs contain tasks that generate reports related to particular areas of monitoring. When a task's dialog is launched, the current tree object is pre-selected in the search criteria fields. Users are allowed to change to some other object in the plan. These dialogs do not allow pre-selected values to be altered.

Alarms View

The **Alarms** view displays alarms for objects in a user's allowed monitoring set. Alarm counts on the summary line at the bottom of the frame reflect this. The alarm query function restricts the scopes by which a user is allowed to search. In the dialog used to enter search criteria, the scope type field contains possible values. Upon selection, however, the instance field only contains selections for objects in a user's allowed monitoring set.

Security View

The Security view previously provided a Network Plan-wide view of rogues and their associated clients. This information is based on certain types of alarms raised against device objects. This view is changed so it only displays information based on alarms raised against devices in a user's allowed monitoring set.

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Reports View

Tasks available in **Reports** are based a user's privileges and limits the generation and viewing of reports. The following reports are based on a user's monitoring privileges:

Report	Available Search Scopes	Notes
Client Summary, Client Errors	NetworkPlan, MobilityDomain, MX, Site, OutdoorArea, Building, Floor, CoverageArea	
Client Details		Dialog only prompts for username, IP address, and client MAC as search criteria. Report generation logic needs to filter the results to only display the clients associated with the set of devices per user has privileges.
Top APs	NetworkPlan, MobilityDomain, MX, Site, OutdoorArea, Building, Floor	
Network Usage (Port Traffic)	NetworkPlan, MobilityDomain, MX	
Network Usage (Radio Traffic)	NetworkPlan, MobilityDomain, Site, Building, Floor, AP, Radio	
Rogue Details		Dialog only prompts for MAC address. Report generation logic should filter the results to only display rogue information if it was detected by a device in the user's allowed monitoring set.
RF Summary	Site, OutdoorArea, Building, Floor, AP, Radio	
Security		Dialog does not prompt for any search criteria. Report generation logic should filter the results to only display information related to the devices in the user's allowed monitoring set.
Radio Details	Radio	
Rogue Summary, Alarm Summary, Alarm History	NetworkPlan, MobilityDomain, Site, OutdoorArea, Building, Floor	
Client OUI		Dialog does not prompt for any search criteria. ISSUE: What type of filtering needs to be done?

Web Pages

Access Control web pages support configuration for:

- User,
- User Group, and
- Radius Servers

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On the **Access Control** Web page you can enable or disable Access Control functionality. You can perform user operations on this page. On the **RADIUS Servers** page you can set up the parameters for RADIUS Servers.

Grouping

As networks continue to scale, the need for a network partitioning feature grows. With larger installations, responsibility for managing a network is distributed among individuals, where each one is concerned only with a particular subset of the overall network. The way networks are partitioned is dependent on the structure of the associated business. It may be physical location-oriented (e.g. a group of Sites), or it may be more logical (e.g. department-oriented).

This feature provides a user flexibility to partition a network in a way that matches their organization and their IT support group. The access control feature provides an ability for an administrator to assign privileges to various entities throughout a network. Network partitioning provides a way of identifying entities at a high level, rather than individually.

Refer to the publication *RingMaster Configuration Guide* for details on setting up Groups for your network.

Object Groups

Two types of object grouping schemes are supported:

- Equipment groups, and
- Location groups.

There is no direct relation between these two and users may choose to use both, just one, or no grouping scheme at all.

Equipment Group

An equipment group can contain the following types of objects:

- **Mobility Domain** – All member devices are implicitly included as equipment group members.
- **Standalone MX** – A device not associated with a Mobility Domain
- **Mobility Domain member MX** – A device associated with a Mobility Domain where the Mobility Domain as a whole is not a member of the equipment group.

Equipment groups can be created under a top-level plan object, or under a Mobility Domain.

Organizer

The equipment organizer tree is enhanced to support the concept of equipment groups. Equipment group nodes appear in the tree to contain associated device and/or Mobility Domain members. Device nodes hang directly under an equipment group node, unless a device's Mobility Domain is a member of the group. Selecting a device node, reveals any Mobility Domain membership information in the configuration view's detail panel.

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Cluster Configuration

Whenever a Mobility Domain is cluster-enabled, an associated Cluster node will appear in the organizer. This node will contain the cluster's seeds, members, and the DomainConfiguration node. The following example illustrates a simple case involving no equipment groups. A MobilityDomain's cluster node may appear multiple times in the tree. There is no method for assigning a cluster as a whole to an equipment group. Only devices and Mobility Domains can be assigned to a group. One restriction is enforced regarding assignment of devices to equipment groups, which is that, if a device is a cluster seed, the other cluster seed must also be assigned to the same equipment group. This is required to ensure that a deploy target switchover will not to be rejected due to access control restrictions.

Flat View

The organizer is enhanced to provide a context-sensitive "flatten" operation that can be invoked on group nodes. This transforms a selected subtree into a flat list of immediate child nodes. Child node labels include the labels of all collapsed parent nodes, separated by a "**:**" character. Only members of the equipment group will be represented as child nodes.

Group Creation

Equipment groups are created in the configuration view by selecting a top-level plan object or a MobilityDomain object and invoking a **Create Group** task. This opens a dialog where you assign a name to the group and select objects to become members.

Location Group

A location group is used to group RF planning-related objects. A location group is limited to Site containment. In future releases, this may be enhanced to allow individual buildings, floors, outdoor areas, coverage areas, and placed AP to be added to a location group.

Group Usage

Monitoring View

Support for equipment groups and location groups has been added to the **Monitoring** view. Location and equipment groups are represented in the monitoring view's organizer. The tree nodes for these objects provide a scope for displaying group-specific aggregated monitoring data. The monitoring view organizer provides a way to inhibit the display of group objects in the tree. The organizer contains a toggle button to control whether or not group nodes are displayed.

Client Monitor

The **Client Summary** view is enhanced to provide a **Clients by Location Group** option when a plan object is the selected scope in the **Sites** organizer. If the organizer is in **Equipment** mode, a **Clients by Equipment Group** option is provided when the plan object is the selected scope. The **Find Clients** function is enhanced to provide searching by a location group or equipment group

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Reporting

The scope selection feature in the reporting module supports the new location and equipment group objects. The table below lists each type of report and the type of support that has been added.

		New Scope Support	
Report Type	Report Type	Equipment Group	Location Group
Inventory	Network Plan, Mobility Domain	Y	
Mobility Domain Configuration	Mobility Domain		
MX Configuration	Mobility Exchange		
Client Summary	Network Plan, Mobility Domain, Mobility Exchange, Site, Outdoor Area, Building, Floor, Coverage Area	Y	Y
Client Details			
Client Errors	Network Plan, Mobility Domain, Mobility Exchange, Site, Outdoor Area, Building, Floor, Coverage Area	Y	Y
Top APs	Network Plan, Mobility Domain, Mobility Exchange, Site, Outdoor Area, Building, Floor	Y	Y
Network Usage (Port Traffic)	Network Plan, Mobility Domain, Mobility Exchange	Y	
Network Usage (Radio Traffic)	Network Plan, Mobility Domain, Site, Building, Floor, AP, Radio	Y	Y
RF Summary	Site, Outdoor Area, Building, Floor, AP, Radio		Y
Radio Details	Radio		
Rogue Summary	Network Plan, Mobility Domain, Site, Outdoor Area, Building, Floor	Y	Y
Rogue Details			
Alarm Summary	Network Plan, Mobility Domain, Site, Outdoor Area, Building, Floor	Y	Y
Alarm History	Network Plan, Mobility Domain, Site, Outdoor Area, Building, Floor	Y	Y
Security			
Client OUI			
Site Survey Order	Network Plan, Site, Building, Floor, Outdoor Area		Y
Work Order	Network Plan, Site, Building, Floor, Outdoor Area		Y

Alarm Queries

The query feature in the **Alarms** view is enhanced to support filtering by instances of equipment group or location group.

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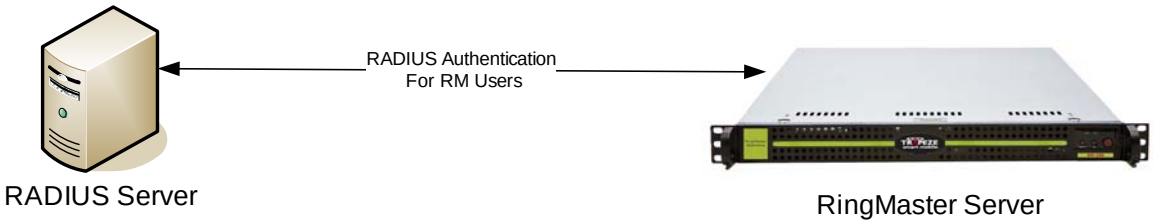
RADIUS Authentication

Currently, *RingMaster* uses basic authentication in which user names and passwords are stored in a local data store. In addition, RADIUS-based authentication is supported by *RingMaster*.



A new option is available to enable RADIUS Authentication. If this option is enabled, a user must provide the following RADIUS server information:

- IP Address
- Key
- Port (default 1812)
- Timeout (default 5 seconds)
- Retry Count (default 3 retries)

Users can configure one primary RADIUS server and one secondary RADIUS server globally, across all network plans. If a user is successfully authenticated, the RADIUS server will send an Access Accept response. This response will contain a custom VSA (Trpz-RM-User-Group) for the user group to which the user belongs. *RingMaster* software restricts user access based on the user group returned by the RADIUS Server. If RADIUS authentication is enabled, users must specify a default user group. This user group is used if the RADIUS server does not return a VSA. If the RADIUS server returns an invalid VSA, user access is rejected.

The administrator is able to configure local users. This is optional. Administrators can provision a user and not have to wait until the user is added to a central RADIUS server. Any user trying to connect to the *RingMaster Server* is first authenticated locally. If local authentication fails, the user is authenticated using the configured RADIUS server. If access control is enabled, there should be at least one user configured locally. This ensurse that a user can access *RingMaster* even if the RADIUS server is unreachable.

Managing the WMS1200-LA

Integrating the WMS1200-LA with RingMaster allows you to manage an WMS1200-LA using network management software. After adding the WMS-1200-LA to your network plan, you can manage, plan, and configure RFID listening APs from a central server.

The integration of the WMS1200-LA into RingMaster is supported by software version 6.4.1 or higher on the WMS1200-LA .

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Adding a Managed WMS1200-LA to RingMaster

To add an WMS1200-LA to RingMaster, you must install an WMS1200-LA in your wiring closet or have it located somewhere in your network. After installation, you need the following information to add the WMS1200-LA to RingMaster:

- IP Address
- User Name
- Password

You also need a Location Appliance license in order to activate the feature in RingMaster. After installing the license, the **Create Location Server** task is available in the RingMaster interface.

To add an WMS1200-LA to RingMaster, follow these steps:

1. Open RingMaster and click **Configuration** from the menu bar.
2. From the **Organizer** panel, select **Application Servers**.
3. From the **Task** list, select **Create Location Server** and the associated wizard opens.
4. Select **Managed** to allow RingMaster to manage the location appliance.
5. In the **Name** field, enter the name of the WMS1200-LA .
6. Enter the IP address.
7. Enter the User Name.
8. Enter the Password.
9. If there is a management password, enter the password in the **Management Password** field.
10. Click **Next**. RingMaster connects to the WMS1200-LA and establishes a connection.
11. Click **Finish** to complete the configuration.

The WMS1200-LA now appears in the **Organizer** panel under **Application Servers**.

To review WMS1200-LA settings, highlight the Location Appliance in the list and click **Properties**. You can then change any of the original settings for the server.

Available Tasks for All Managed WMS1200-LA Location Appliances

There is a list of available tasks for all location appliances managed by RingMaster. You can select any of the following tasks:

- Create Location Server
- Setup Synchronization Parameters
- Edit a Location Server
- Configure a Snoop Filter
- Configure SNMP Settings

From the **Other** List, you can select from the following tasks:

- Platform Management
- Appliance Logs
- Backup and Restore

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- Configuration
- Factory Reset
- Schedule Reboot
- System Update
- User Management

Selecting any of the **Other** tasks opens the corresponding software feature on the location appliance. For more information on using these features, refer to the *Juniper Networks WLM1200-LA User's Guide*.

Available Location Appliance Tasks

If the location appliance already has a configuration, the details are displayed when you select the WMS1200-LA in the Organizer panel.

After selecting it, the following information is displayed:

- Location Server
- Managed
- Name
- Port
- Version
- IP Address
- Locales
- Name
- Description
- Associated Fingerprints
- Associated Floor
- RF Fingerprints
- Name
- Description
- Associated Locale

In the **Tasks** panel, you can select from a list of available tasks. Under **Create**, you can select

- Create Locale
- Create RF Fingerprint

Under **Setup**, you can select

- Synchronize
- Edit Location Server
- Snoop Filter
- SNMP

Under **Other**, you can select

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- Platform Management
- Appliance Logs
- Backup and Restore
- Configuration
- Factory Reset
- Schedule Reboot
- System Update
- User Management

Selecting any tasks under **Other**, opens the operating system of the location appliance and you can perform any of these tasks directly on the location appliance.

Synchronizing Changes on a Location Appliance using RingMaster

To synchronize configurations on a location appliance, use the following steps:

1. In the **Task** list, click **Synchronize**.
2. The **Review Changes** panel is displayed.
3. You can select from two types of action:
   - Deploy Changes to the location appliance - changes made using RingMaster are applied to the location appliance.
   - Accept Changes from the location appliance - changes made on the location appliance are uploaded to RingMaster.

You cannot undo this operation. Once you click **Next**, the changes are synchronized between RingMaster and the WMS1200-LA .

4. Click **Next**. The changes are synchronized between RingMaster and the location appliance.
5. Click **Finish** to complete the operation.

The WMS1200-LA image created using RingMaster is transferred to the WMS1200-LA where it is used by other applications such as Active Asset. It is recommended that you create a backup of your current image before transferring the new on to the WMS1200-LA.

Monitoring the WMS1200-LA

You can view status information on the WMS1200-LA when you click Monitoring and then select the WMS1200-LA from the Organizer panel.

The Monitor feature displays the following information:

- **Status Summary** — click Details for more information.
  - **Appliance Name**
  - **Status**
  - **Admin Status**

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  - **IP Address**
  - **Server Type**
  - **Management Port**
  - **Version**
  - **Up Time**
- **Alarm Summary** — click **Details** for more information.
- **Clients by Locale** — you can also click **Find Clients** to search for clients on the network.
- **Tracked Devices by Type**

Additional WMS1200-LA Areas Monitored by RingMaster

There are additional features on the WMS1200-LA that can be monitored by RingMaster. When you select a floor with a WMS1200-LA, a new Show Devices task is available. This task displays all the devices tracked by the WMS1200-LA including:

- Clients
- Tags
- APs
- Rogue APs

You can filter the devices displayed using the following strings:

- SSID
- User Name
- MAC Address
- IP Address
- End Address for SIP
- Radio Technology

When you use the filtering capabilities, only the devices matching the filter are displayed. Once you clear the criteria, all devices are displayed again.

You can also hide or display the following items on the **Monitoring** interface:

- Locales
- Fingerprints
- APs
- Clients (Voice and Data)
- Tags
- Rogue APs
- Client and AP Connections

When you select **Show Devices** and then select an asset tag, you can see the temperature of the tag as well as the battery life for the tag.

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Managing Devices

Clicking on the **Devices** button on the Navigation Bar brings up the following window containing the **Devices Dashboard**:

The **Tasks** panel contents change depending on whether the **Change Management** or the **Device Operations** tab near its bottom are selected. The next paragraphs describe the items shown in the **Tasks** panel for each.

Change Management Tab Items

This dashboard provides information on WLCs in a network, and provides access to the following functions and or tasks:

- **Local Changes**
  - **Review**
  - **Deploy**
  - **Schedule Deploy**
  - **Undo**
- **Network Changes**
  - **Review**
  - **Accept**
  - **Undo**
- **Go To**
  - **Go to Configuration**
  - **Go to Verification**
- **Other**
  - **Refresh**
  - **Upload MX**
  - **View Operations Log**
  - **Cancel Operation**

Local Changes

Undo deletes all local changes from *RingMaster*. Deleted changes are not deployed to an WLC.

Network Changes

Network changes can be reviewed in the same manner as local changes. Click **Review** to examine items created, deleted, or modified on an WLC via CLI, Webview or another instance of *RingMaster* appliance. Click **Accept** to store network changes in *RingMaster* and allow them to be managed. To cancel or undo network changes and revert an WLC configuration to the stored *RingMaster* configuration, do this:

1. Click **Undo** network changes.

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2. Click **Deploy** local changes.

All local changes made before clicking “Undo network changes” are deployed at step 2.

- Device Operations Tab Items
  - **Images**
    - **Image Install**
    - **Schedule Install**
    - **Image Repository**
  - Actions
    - **Reboot MXs**
    - **Manage Device**
    - **Unmanage Device**
    - **Distribute Certificates**
  - Go To
    - **Go to Configuration**
    - **Go to Verification**
  - Other
    - **Refresh**
    - **Upload MX**
    - **View Operations Log**
    - **Cancel Operation**

Managing Policies

Selecting **Policies** on the Navigation Bar shows policies related to a selected item in the **Organizer** panel.

Policy Tab Items

- Policy Changes
  - **View**
  - **Apply**
- Setup
  - **Areas**

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Viewing Policy Changes

After selecting the **Policies** tab, selecting **View** in the **Tasks** panel allows you to view policy changes. Selecting an item in the **Changed List** of the dialog that appears shows policy changes related to that item.

Click **Print** for a copy and **Close** when done.

Applying Policy Changes

After selecting the **Policies** tab, selecting **Apply** in the **Tasks** panel allows you to apply policy changes. Selecting an item in the **Changed List** of the dialog that appears shows policy changes related to that item.

Click **Apply** to apply changes and **Close** when done.

Selecting Policy Areas

After selecting the **Policies** tab, selecting **Areas** in the **Tasks** panel allows you to select policy areas. Configuration Management

Any changes you make to a network in *RingMaster* are saved in a network plan on the server, but changes are not applied to the network until they are deployed. You see changes in *RingMaster*, but these changes are only present in a network plan until you deploy them to the WLCs in a network. You can apply a configuration to multiple WLCs, or deploy changes to a single WLC. *RingMaster* allows you to deploy changes immediately, or to schedule deployment.

Reviewing Local Changes

Select device(s) with local changes and click **Review**. Examine changes pending for an WLC. The **Review** window is a table with expandable rows to drill down to individual attributes. Created items are green, deleted items are orange, and modified items are black. Click **Print** for a copy and **Close** when done.

Local changes cannot be deployed when network changes are detected. You must first accept or undo network changes.

Deploying Local Changes

To deploy local changes immediately:

1. Select the **Devices** Navigation Bar button.
2. At the bottom of the **Tasks** panel, select **Change Management**.
3. Select one or more managed WLCs. To select multiple WLCs, press **Shift** (for contiguous WLCs) or **Control** (for non-contiguous WLCs) while clicking. Multiple selection enables tasks applicable to all selected devices, including reviewing local changes.
4. In the **Local Changes** group in the **Tasks** panel, click **Deploy**. The **Deploy Configurations** dialog box appears. This dialog lists MX **Mobility Domain**, **Version**, **Status**, **History** and **Selected Errors**.

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5. Click **Close**.

This dialog may show verification errors. Resolve these using the Verification button on the Navigation Bar. You can click **Close** at any time after clicking **Deploy**. The operation continues in the background. To review the status of the operation, use the operation log. (Select **View Operation Log** in the **Tasks** panel.)

Scheduling Deployment

To schedule local change deployment:

1. Select the **Devices** Navigation Bar button.
2. At the bottom of the **Tasks** panel **Local changes** group, select **Schedule Deploy**.
3. Select one or more WLCs. To select multiple WLCs, press **Shift** (for contiguous WLCs) or **Control** (for non-contiguous WLCs) while clicking.
4. In the **Tasks** panel in the **Local Changes** group, click **Schedule Deploy**.

   If there are errors preventing deployment, an error message is displayed.

   When errors are cleared, this deployment must be repeated.
5. The **Schedule Deploy** dialog box is displayed.
6. Edit the **Start date** and **Start time**. (Date and time are based on the date and time on the machine where *RingMaster Services* are installed.)
7. Click **OK**.

Verifying Deployment

1. Leave the **Devices** Navigation Bar button selected.
2. Review the **Deploy Status** column for the switch(es) to which you deployed configuration information. The status should be **Completed (Date)**. You also can verify successful deployment by checking the operation log.

When a local change or image deploy hangs and is incomplete, an WLC is locked by *RingMaster* and cannot be modified. This is a special server-side lock that cannot be removed via the **Lock Management** *RingMaster* server Web page. You must remove this lock by selecting an WLC row and clicking **Cancel operation**.

Accessing the Log

1. Select the **Devices** Navigation Bar button.
2. At the bottom of the **Tasks** panel, select **Device Operations**.
3. In the **Tasks** panel, select **View Operations Log**.

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Performing Basic Administrative Tasks

This section contains information about basic administrative tasks you perform in *RingMaster*. For detailed information about administrative tasks, such as configuring WLC management services, refer to the "Configuring MX System Parameters" chapter in the publication *RingMaster Configuration Guide*. For more information about image and file management, see the chapter "Managing MX System Images and Configurations" in the *Trapeze Mobility System Software Command Reference.*

Configuring WLC Management Services

You configure the following information and management services for an WLC:

- **System information** — You can specify system contact information, as well as CLI prompt and the banner message that appears in each session.
- **HTTPS** — By default, HTTPS is enabled. TCP port 443 is used for secure access by *Web View*, the Juniper Networks Web-based application for managing an WLC.

RingMaster communications also use HTTPS, but *RingMaster* is not affected by the HTTPS configuration on an WLC. For *RingMaster*, HTTPS is always enabled and listens to port 8889.

- **Telnet** — By default, Telnet is disabled. You can enable Telnet for unencrypted access to the CLI.
- **SSH** — By default, SSH is enabled. You can use SSH for encrypted access to the CLI.
- **SNMP** — By default, SNMP is disabled. You can configure SNMP community strings and User Security Model (USM) users, notification profiles, and notification targets.
- **Logging** — The system log provides event information for monitoring and troubleshooting. You can send the log information to a local data buffer on an WLC, to the console, to a Telnet session, and to a configured set of syslog servers.
- **Tracing** — Tracing allows you to review diagnostic information for debugging MSS. Tracing allows you to review messages about the status of a specific area of MSS.
- **Time zone** and summertime settings — You can statically configure system time and date. You can configure MSS to offset the time by an additional hour for daylight savings time or similar summertime period.

To manage services on an WLC:

1. Select the **Configuration** Navigation Bar button.
2. In the **Organizer** panel, select an WLC.
3. Click **System**.
4. Select **Management Services**. Management services/settings appear in the **Content** panel.
5. Use the **Content** panel and **Tasks** options to modify settings. (For information about management options, refer to the "Configuring WLC System Parameters" chapter in the publication *RingMaster Configuration Guide*.)

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Distributing System Images

You can use *RingMaster* to upgrade or downgrade a system image (MSS software) on WLCs. System images include switch software and AP software.

Using the Image Repository

Use the image repository to add or delete WLC system images. An image file is checked and its version verified when it is added to the image repository. Images are stored in the **RingMaster_installation_directory\images\dp** directory.

To add a system image:

1. Select the **Devices** Navigation Bar button.
2. At the bottom of the **Tasks** panel, select **Device Operations**.
3. From the **Tasks**, select **Image Repository**.
4. Click **Add Image**. The **Add to Repository** dialog box appears.
5. Navigate to the directory containing the system image.
6. Select the system image.
7. Click **Add to Repository**. The image is added to the image repository and appears in the Image List.
8. To close the **Image Repository** dialog box, click **Close**.

To delete a System Image:

1. In the **Image Repository** dialog box, select an image to delete.
2. Click **Remove Image**. A prompt appears.
3. Click **Yes** to delete the system image.
4. To close the **Image Repository** dialog box, click **Close**.

You can distribute a system image to one or more WLCs in a network plan. To use a new system image, you must reboot an WLC.

Juniper Networks recommends that you use the **Verification** button to resolve any configuration errors or warnings before you distribute system images. See “Verifying Configuration Changes” in the publication *RingMaster Configuration Guide*.

Before you can distribute an image, you must add it to the image repository. (See **Using the Image Repository**.)

To immediately install an image on WLCs:

1. Select **Devices**.
2. From the **Tasks**, select **Device Operations**.
3. From the **Managed Devices** list, select WLCs to install the image. To select more than one WLC, click **Shift** while clicking to select contiguous items, or click **Ctrl** (Macintosh: **Command**) while clicking to select noncontiguous items.

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4. In the **Tasks** panel, select **Image Install**.
5. Click **Select** an Image to display the list of images in the repository.
6. Select the image and click **Install**.

1. To schedule installation of an image on WLCs:
2. Select the **Devices** Navigation Bar button.
3. At the bottom of the **Tasks** panel, select **Device Operations**.
4. In the **Managed Devices** list, select the WLCs to install an image. To select more than one WLC, click **Shift** while clicking to select contiguous items, or click **Ctrl** (Macintosh: **Command**) while clicking to select noncontiguous items.
5. In the **Tasks** panel, select **Schedule Install**.
6. Click **Select** an Image to display the list of images in a repository. Click **Next**.
7. Edit the start date and time. (The date and time are based on the date and time on the computer with the *RingMaster Services* installation.) Click **Finish**.

Saving Versions of Network Plans

You can save multiple versions of a network plan in *RingMaster*. After deploying a network plan to an WLC, you can save a snapshot of the plan as a version. You should create versions of a network plan on a regular basis, and at major baseline events, for network configurations. This stores snapshots of network configurations in case you need to revert to one of them. If you need to roll back configuration changes, you use a saved version to roll back the software image and configuration files to a known state. Before you save a version of a network plan, you must deploy and save the network plan.

Versions of network plans are saved in the **db/xml/versions** directory in the *RingMaster* installation directory. After saving a version of a network plan, a version appears in the list of available network plans. If you open a version of a network plan, you can deploy it or open it. When a version is open, its version name is displayed in the title bar of the *RingMaster* window.

To save a version of a network plan:

1. Select **Services > Plan Management**. The **Plan Management** page is displayed in your default browser.
2. In the left-hand column of the page, click **Save As**. The **Save As Network Plan** window is displayed.
    1. In the **Network Plan Name** field, type a name for the plan.
    2. Click **Save**.

Saving Network Plans Automatically

By default, *RingMaster* uses the autosave feature to automatically save changes to a network plan at regular intervals. To view or modify backup settings, select **Services** > **Backup & Restore** to display **Backup & Restore** in a browser window.

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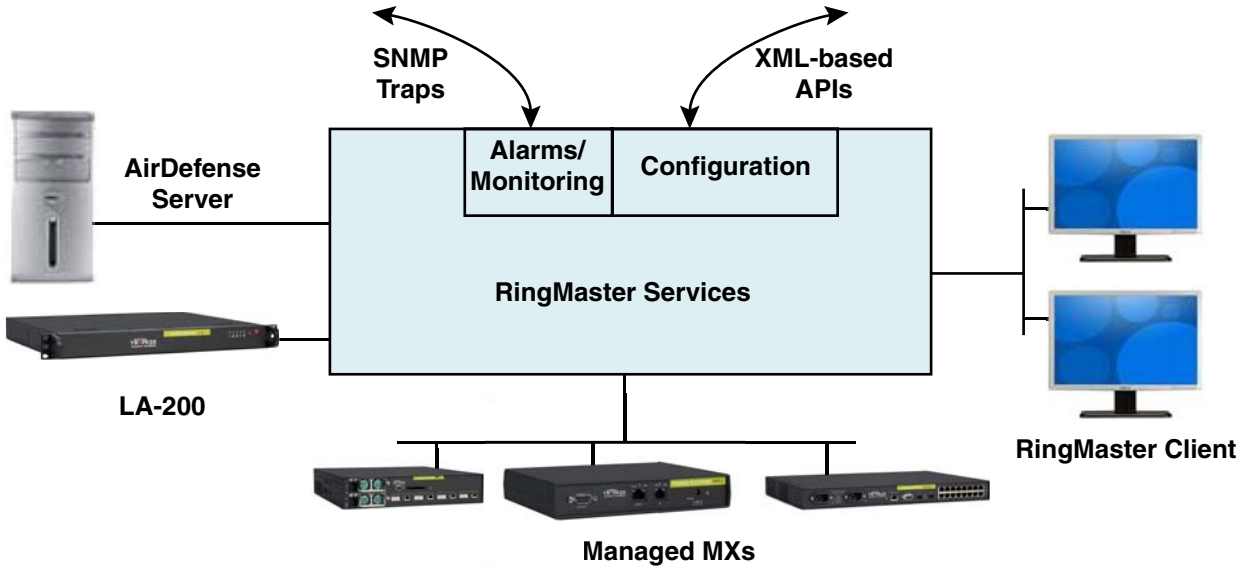
RingMaster SNMP Agent



The *RingMaster SNMP Agent* provides access to allow upstream application programs to perform WLAN management tasks without GUI interaction. An upstream application can retrieve the configuration of MPs in a *RingMaster* managed network domain. This software can, for example, get information on a set of MPs by serial number or MP type. After an upstream application binds to utilize the *RingMaster SNMP Agent*, that application can initiate transactions using this interface.

The capabilities enabled by *RingMaster SNMP Agent* include:

- **Client/session information**
- **Alarms**
- **Monitoring**
- **Security (rogues, neighbor lists, etc.)**
- **Policies**
- **Reports**
- **RF Planning**
- **Software Generics Management**

Transactions enacted between upstream application(s) and the *RingMaster SNMP Agent* are often scoped with regards to applicable managed entities. This limits the amount of time an upstream application needs to process resulting information flows. *RingMaster SNMP Agent's* interface meets recommendations of standards authorities such as the World Wide Web Consortium (W3C). See the figure above for a high-level view of interfaces. The *RingMaster SNMP Agent* software's goal is to provide programmable access to upstream applications so they can accomplish required WLAN management tasks without GUI interaction. There are two interfaces that will be available as described in the next paragraphs.

This interface allows use of an XML API to query configuration and monitoring data. It uses REST based web services for easy integration. It uses standard Internet protocols including XML over HTTPS,

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Web Services API

The *Web Services API* is used to set up the SNMP interface and provide other alarm / inventory details using polling rather than using a trap mechanism.

- The Agent version is the REST interface version which is not the same as the *RingMaster* software version. This is defined for upgrades and future use.
- The Web API provides an alarm summary from the *RingMaster* alarm module (each alarm type, criticality and their counts). The alarm summary can be filtered based on query criteria using the Web API. (For example, client failure alarms with a certain SSID).
- The Web API provides inventory information, such as a list of devices (WLCs and APs) and their information in *RingMaster* (name, model, serial number, build number, system IP, location, contact info, admin state, and operational status).

For configuration of this API, refer to the publication *RingMaster Web Services API*.

SNMP Traps

SNMP traps provide a standards-based mechanism for encoding and delivery of *RingMaster* alarms and retrieval of status and configuration information.

The *RingMaster Agent* supports new components including the RM-200 Appliance.

The SNMP Trap interface is designed to provide an asynchronous mechanism for encoding and delivering *RingMaster* alarms and monitoring information.

Areas of integration are:

- **Fault Management** — Monitors of enterprise network infrastructure, such as HP *OpenView*
- **Security** — WLAN intrusion detection and prevention systems (IDS/IPS), example, Enterasys *Dragon*.

Network alarm notifications are made by:

- Correlation of SNMP Traps across WLCs
- Correlation of AirDefense Traps across WLCs
- Periodic audts by *RingMaster*

Configurable notification filters can be set using the SNMP Manager to filter alarms by:

- Alarm Category
- Alarm Severity

Alarm Notifications Via SNMP Traps

The SNMP interface deals primarily with alarm notification.

- The *RingMaster Agent* generates SNMP v1 and v2c traps.
- The SNMP interface forwards alarms as SNMP traps, including alarms created and correlated from WLC traps, alarms generated from *RingMaster* itself, and alarms collected from other sources, such as AirDefense traps.
- The *RingMaster* agent sends an SNMP trap when an alarm's state changes, such as when an alarm is cleared or acknowledged, or when it is updated.

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- To deal with a burst of cleared or new alarms, the *RingMaster Agent* buffers traps at a configurable interval sends them during a specified interval. This update interval can be configured via The *RingMaster's* Web interface.

RingMaster Agent License

RingMaster Agent is a licensed feature. The license SKU is **RMTS-AGENT** and it works just like the **RMTS-PLAN** license. It needs a base RMTS license installed first.

Product Code	SKU	Description
02	RMTS	Base license enabling support for up to 5 APs and one switch.
07	RMTS-AGENT	Enables RingMaster Agent feature

WebAPI Interface

The Web Services API provides a management interface. It allows third party applications to build interfaces or applications to access or manage devices and alarms. For example, an upstream application can retrieve the configuration of MPs in a *RingMaster* managed network domain. This can be more than a basic query with respect to information requested — for example, a set of MPs corresponding to certain serial numbers or MP type may be requested.

Automatic Image Update

This feature allows users with a SafetyNet login to automatically download MSS software images from the Trapeze Networks support portal. In the past, customers had to connect to the Trapeze Networks support portal to download new software images for WLCs. The auto update feature allows users to update software automatically on a scheduled or on-demand basis. Users are notified when new MSS software is available or downloaded.

This feature performs the following:

- Checks and downloads any new, compatible MSS software images
- Provides the ability to set up automatic updates
- Allows you to specify the frequency and time for automatic updates
- Provides notification options for automatic updates:
  - Notifies when updates are available
  - Notifies when updates are downloaded
- Allows you to perform manual updates
- Provides progress information for manual updates
- Checks the current version of MSS software on WLCs currently in a plan and displays/downloads only relevant software

Auto Update Wizard

The Update panel help you schedule auto updates or perform a manual update.

1. Select the **Upgrade** menu item on the **Tools** menu to bring up the following dialog:
2. Login with your **User Name** and **Password**. You can click a button to verify username and password and to **Update Now**.

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This button checks your **SafetyNet Login** User name and Password and confirm whether it is valid or not and if so you see the window below. This dialog will list and allow you to download updates when available. Click **Close** on this dialog.

When you select a manual update, you see a list of compatible new versions of software, if available, displayed in a table. You can select which software to download and click the **Download** button. If you select software, corresponding files are downloaded .

The system will display the status of the download.

3. If you clicked the **Enable Auto Updates** check box on the previous dialog and clicked **Next** you see the following:

You have the option of scheduling an auto update or performing a manual update.

You can enable auto update, choose an update frequency at which to check the support portal:

- **Daily**
- **Monthly**
- **Weekly**

If you select daily, you then select a time If you select weekly, you then select a day of the week and time. If you select monthly, you then select a date and time.

You are able to select one of the following actions:

- **Notify when the updates are available**
- **Notify after the updates have been downloaded**

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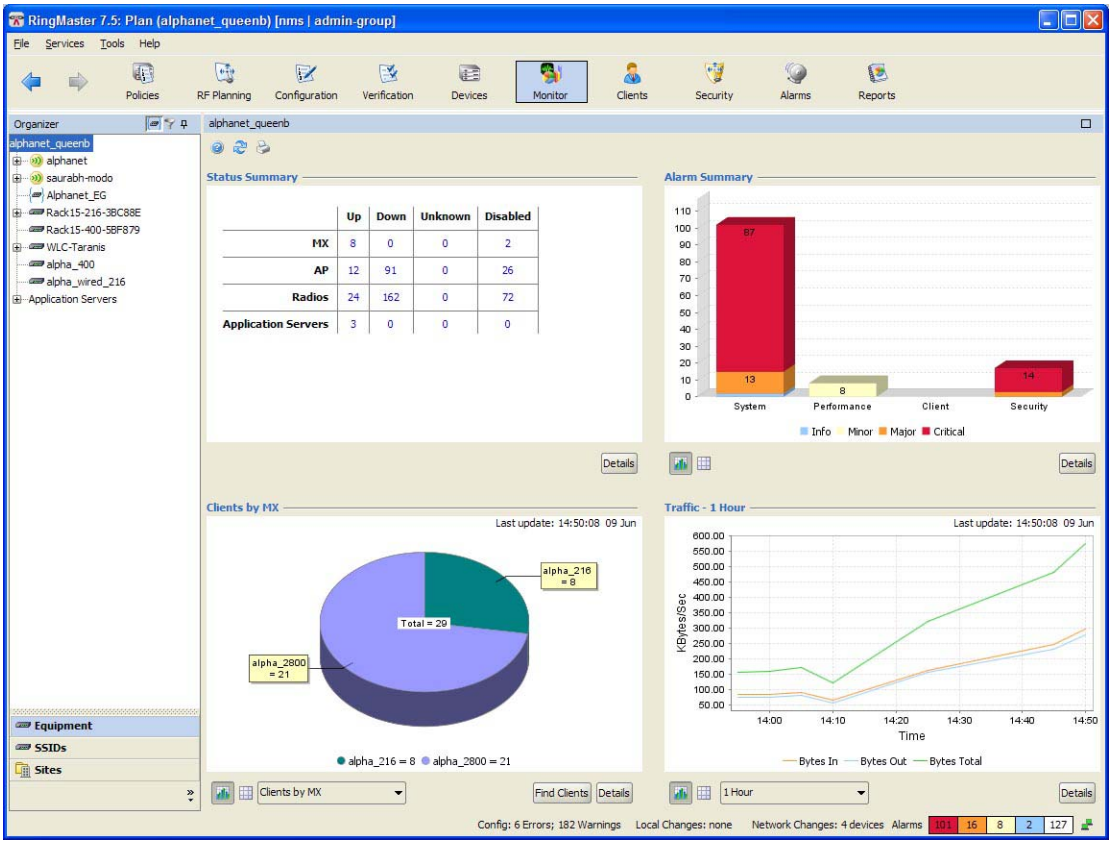
Monitor Function

This chapter highlights the Monitor function, which displays information retrieved by RingMaster. Monitor views show correlated data and let you navigate to details.

Monitoring Dashboards



Information is presented in a four-segment “dashboard” in the **Content** panel when you select the **Monitor** Navigation Bar button:

- **Status Summary** — Shows high-level status for Trapeze equipment. This view changes based on the selections in the **Organizer** panel — Domain, MX, AP or Radio can be selected.
- **Client Summary** — Shows activity, errors, and session information for network clients.
- **Alarm Summary** — Shows faults (alarms) for MXs.

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- **Traffic/Radio Summary** — Shows Traffic Summary or Radio Summary depending on the object selected in the tree. If an WLC is selected, this segment shows a Traffic Summary, but if an AP is selected the segment shows an RF Summary.

Each view provides answers to specific questions, such as the number of clients connected over the last hour, and which WLC has the most traffic load. The **Status Summary**, **Alarms Summary**, **Clients**, and **Radio** sections provide buttons so you can switch between graphical and tabular views in any area. These buttons allow you to see the data behind graphs. *RingMaster* provides many monitoring options. This section describes how to use these monitoring tools to determine problems that are reported.

Clicking the **Details** button in any subview (area) provides more information about data in that view. This chapter provides three monitoring examples to use as a guide to troubleshooting user connectivity issues in a network.

Requirements for Monitoring

To enable *RingMaster Services* to monitor network data, you must specify the WLCs to monitor. *RingMaster Services* software collects data from these WLCs and updates it in views under the **Monitor** Navigation Bar button for *RingMaster* clients. To specify the WLCs to monitor, upload configurations into *RingMaster* or add them to a network plan. In addition, enable SNMP traps on the WLCs. By default, the *RingMaster Services* supplies data to all views under the Monitor Navigation Bar button. This data is refreshed at regular intervals, according to the polling interval configured for *RingMaster Services*. The default polling interval is 15 minutes. You can optionally disable *RingMaster Services* from supplying data to specified views. To configure *RingMaster Services* for monitoring, see “Selecting Monitoring Settings” in the publication *RingMaster Planning Guide*. To enable SNMP traps on WLCs, see “Configuring SNMP” in the publication *RingMaster Configuration Guide*

Network Types

Networks have varying requirements and expectations for network monitoring, depending on the type of network being monitored. The two most common network types are corporate or campus networks, and distributed networks with remote sites.

Corporate or Campus Networks

Corporate or campus networks have two to thirty two high-capacity WLCs, such as WLC2800s. These networks can include a high number of APs and clients in a wide variety of location types, including multiple sites managed by a single *RingMaster* server. One or more mobility domains can be configured for this type of network. *RingMaster* has sufficient bandwidth to periodically collect detailed information from all WLCs in such a network. With SNMP traps and all trending options enabled, *RingMaster* collects data and provides network-wide reports on demand. *RingMaster* provides an administrator with status and fault information, and the administrator can retrieve data at any time from a single WLC or an entire network.

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Distributed Networks with Remote Sites

Distributed networks with remote sites have a large number of smaller WLCs, such as WLC2s or WLC8s, spread over many sites — for example, branch offices or a chain of stores. Each site has few APs and clients. Domains may not be configured for mobility because sites are geographically distributed and each may have only a single WLC. You can configure a network domain for this type of network. For distributed networks, *RingMaster* communicates with WLCs over a WAN. You can turn off data collection and SNMP traps.

You can retrieve fault and status information, but cannot control what is collected or *RingMaster* polling intervals. With *RingMaster*, the administrator of a distributed network can monitor and diagnose a single site or WLC by collecting data as needed.

While *RingMaster* collects graphical or tabular data, it might take longer to display data in one area than it does in another. Consequently, *RingMaster* displays the message **Loading data, please wait** in the chart or table area. However, *RingMaster* allows you to view data from another view while it collects data from the previously selected view. In other words, *RingMaster* will load selected data in the background so that you can view corresponding data in another section.

Refresh *RingMaster* data by clicking the **Refresh** icon . In addition, you can print displayed tables and graphs by clicking the **Print** icon .

Monitoring With RingMaster

Monitoring capabilities decribed below depend upon restrictions placed on users as described in **Restricted User Monitor View**.

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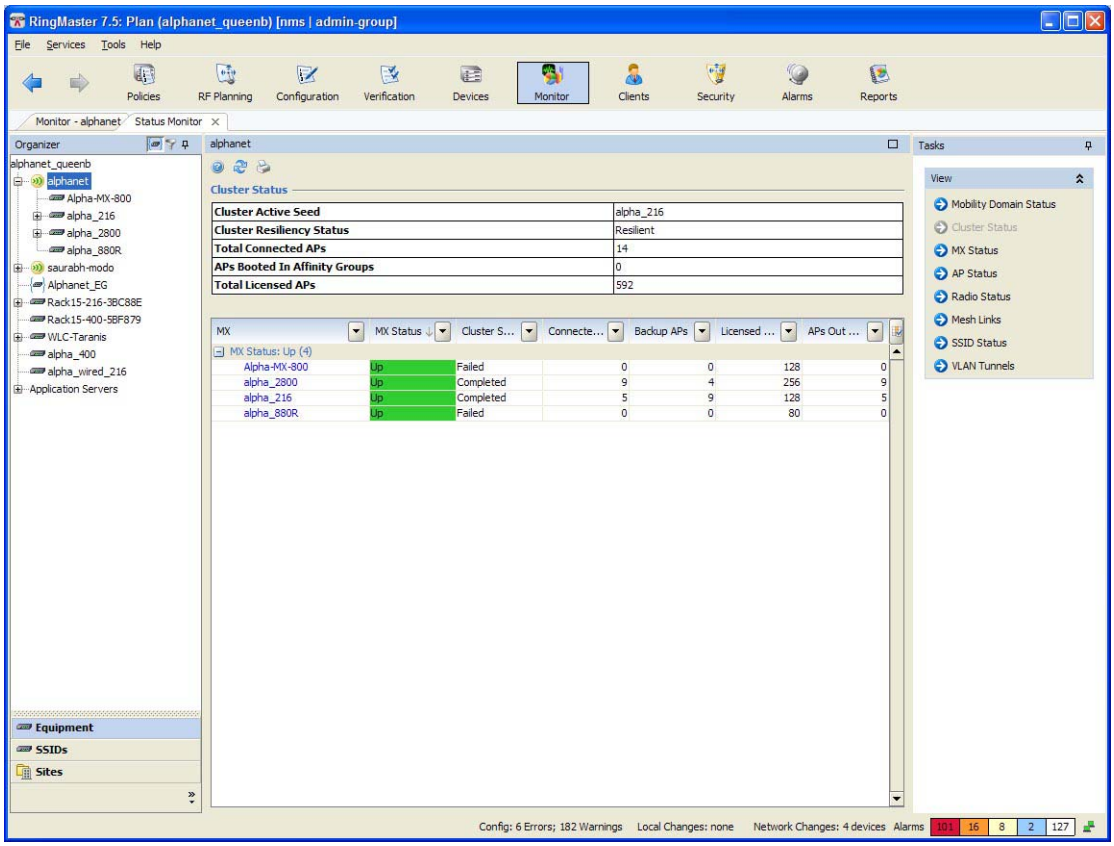
Cluster Status Monitoring

In the **Domain Status** panel, you can click on **Cluster Status** to see the following:



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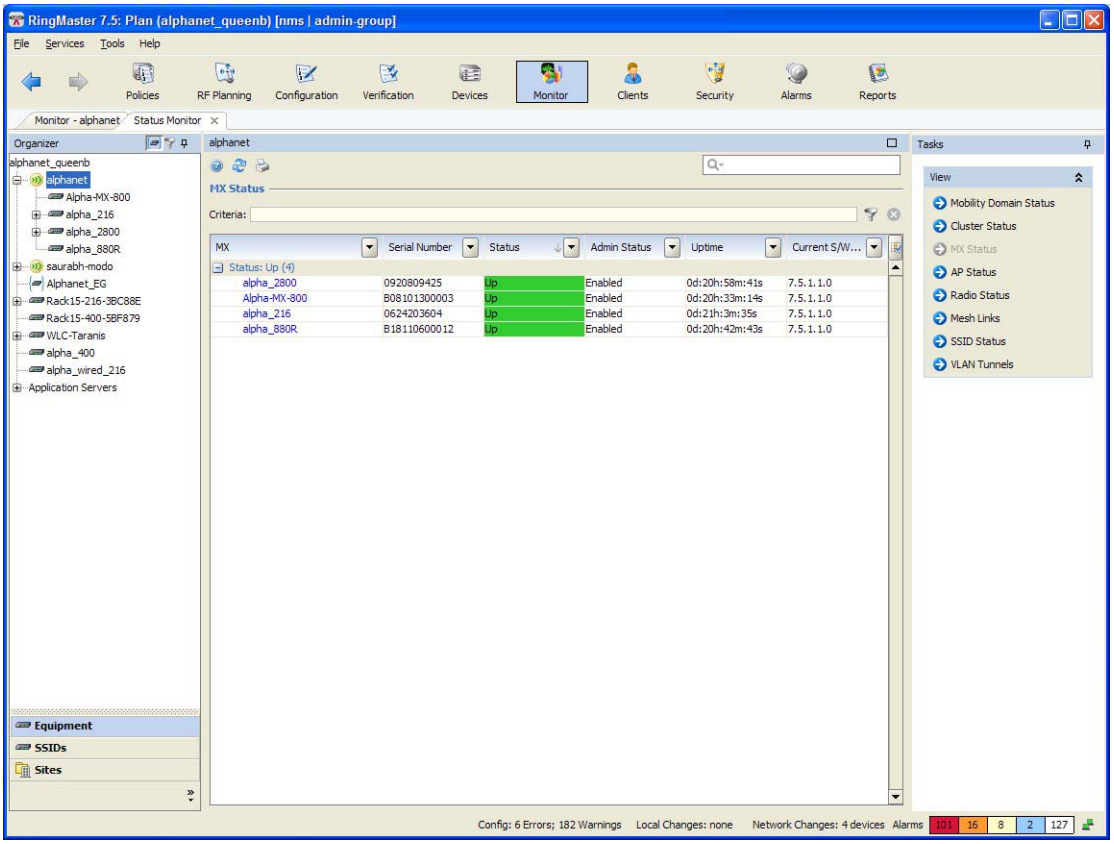
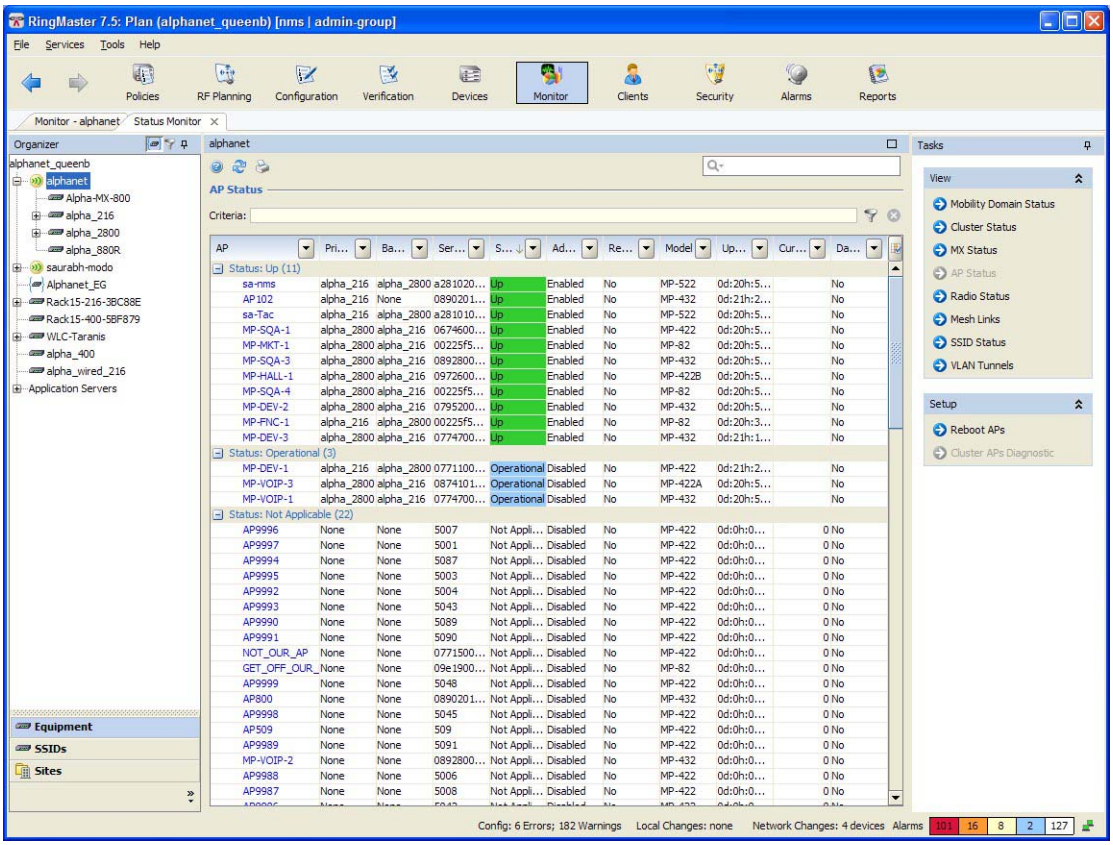
MX Status Monitoring

In the MX Status panel, *RingMaster* shows the status of **MX Status**, including **Fans**, **Power Supplies**, **Licenses** and a table of information about **Ports**.



AP Status Monitoring

In the **AP Status** panel, *RingMaster* shows a new **AP Ports** table that lists **Port**, **Speed**, **Duplex**, and **PoE** for both ports.



IThis table indicates both the Primary WLC andd Backup WLCthat manage each AP. This provides an indication of WLC failover fro Primary to Backup, and failback when a Primary “returns”.

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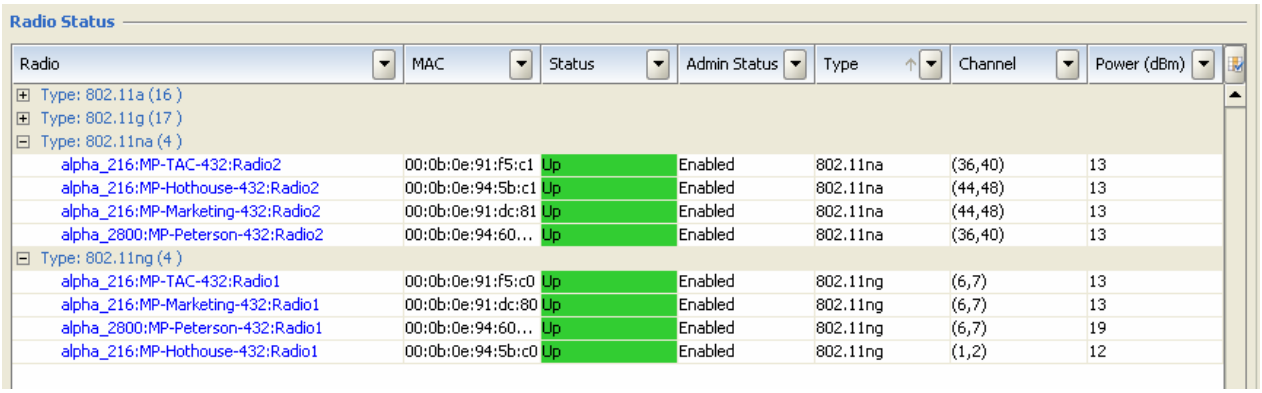
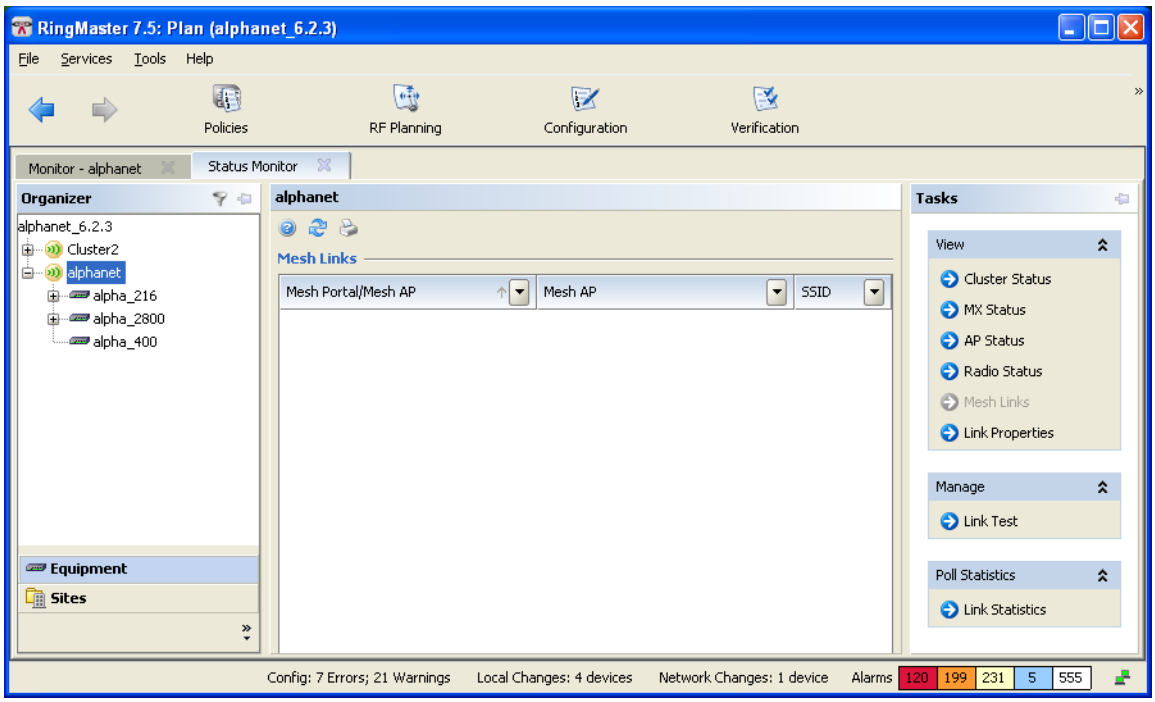
Radio Status Monitoring

RingMaster displays a **Radio Status** monitoring panel. The channel column shows both primary and secondary channels (MP-432s only) in a format of (44, 48). For a radio that is using single channel, the display format is just 44, as before.


Radio Status
Radio
MAC
Status
Admin Status
Type
Channel
Power (dBm)
Type: 802.11a (16)
Type: 802.11g (17)
Type: 802.11na (4)
alpha_216:MP-TAC-432:Radio2 00:0b:0e:91:f5:c1 Up Enabled 802.11na (36,40) 13
alpha_216:MP-Hothouse-432:Radio2 00:0b:0e:94:5b:c1 Up Enabled 802.11na (44,48) 13
alpha_216:MP-Marketing-432:Radio2 00:0b:0e:91:dc:81 Up Enabled 802.11na (44,48) 13
alpha_2800:MP-Peterson-432:Radio2 00:0b:0e:94:60... Up Enabled 802.11na (36,40) 13
Type: 802.11ng (4)
alpha_216:MP-TAC-432:Radio1 00:0b:0e:91:f5:c0 Up Enabled 802.11ng (6,7) 13
alpha_216:MP-Marketing-432:Radio1 00:0b:0e:91:dc:80 Up Enabled 802.11ng (6,7) 13
alpha_2800:MP-Peterson-432:Radio1 00:0b:0e:94:60... Up Enabled 802.11ng (6,7) 19
alpha_216:MP-Hothouse-432:Radio1 00:0b:0e:94:5b:c0 Up Enabled 802.11ng (1,2) 12

Mesh Links Monitoring

Mesh Links monitoring view shows the **Mesh Portal/Mesh AP**, **Mesh AP** and **SSID** of each mesh link.



You can select a mesh link and click on **Tasks** panel items to view **Link Properties**, perform a **Link Test**, or view **Link Statistics**.

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RF Neighborhood Monitoring

RF Neighborhood monitoring view shows the **Mesh Portal/Mesh AP**, **Mesh AP** and **SSID** of each mesh link.

You can select radio buttons to **Show RF Neighbors** by:

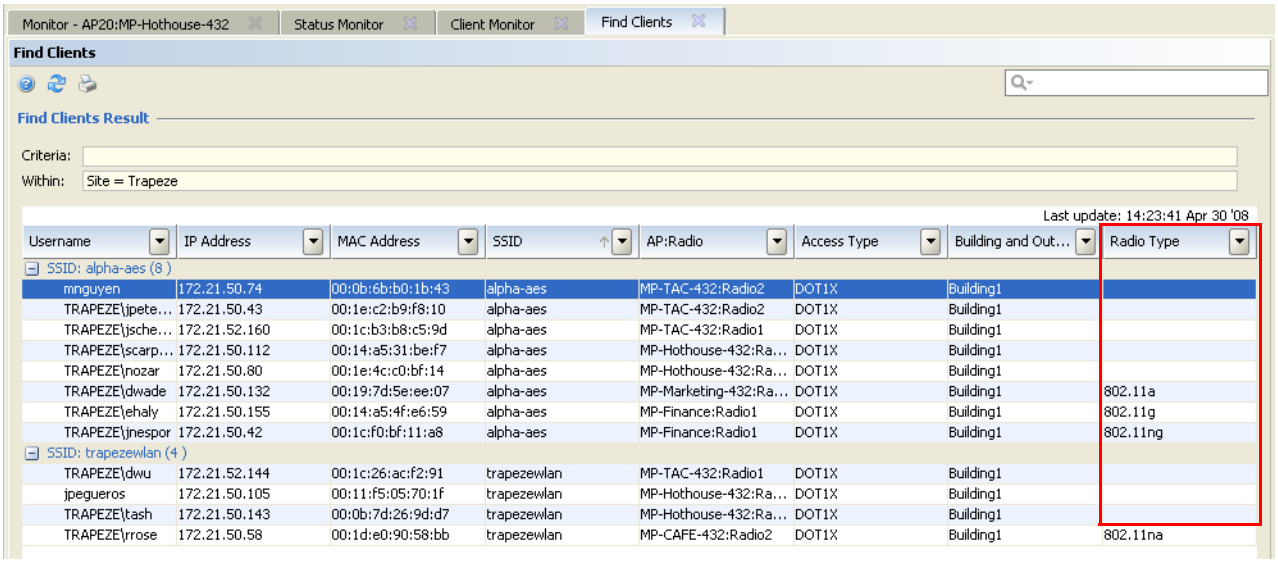
- **Transmitters (heard by this Radio)**
- **Listeners (who heard this Radio)**.

When you click **Refresh**, this dialog lists each **Neighbor**, **BSSID**, **Channel** and **RSSI** for **Trsnsmitters** or **Listeners**, based on which of these buttons is selected.

Client Session Monitoring

RingMaster Client **Session** monitoring changes include:

- *RingMaster Client* session shows the corresponding radio type for each client session.


Monitor - AP20:MP-Hothouse-432
Status Monitor
Client Monitor
Find Clients
Find Clients
Find Clients Result
Criteria:
Within: Site = Trapeze
Last update: 14:23:41 Apr 30 '08
Username
IP Address
MAC Address
SSID
AP:Radio
Access Type
Building and Out...
Radio Type
SSID: alpha-aes (8)
mnguyen 172.21.50.74 00:0b:6b:b0:1b:43 alpha-aes MP-TAC-432:Radio2 DOT1X Building1
TRAPEZE\jpete... 172.21.50.43 00:1e:c2:b9:f8:10 alpha-aes MP-TAC-432:Radio2 DOT1X Building1
TRAPEZE\jsche... 172.21.52.160 00:1c:b3:b8:c5:9d alpha-aes MP-TAC-432:Radio1 DOT1X Building1
TRAPEZE\scarp... 172.21.50.112 00:14:a5:31:be:f7 alpha-aes MP-Hothouse-432:Ra... DOT1X Building1
TRAPEZE\nozar 172.21.50.80 00:1e:4c:c0:bf:14 alpha-aes MP-Hothouse-432:Ra... DOT1X Building1
TRAPEZE\dwade 172.21.50.132 00:19:7d:5e:ee:07 alpha-aes MP-Marketing-432:Ra... DOT1X Building1 802.11a
TRAPEZE\ehaly 172.21.50.155 00:14:a5:4f:e6:59 alpha-aes MP-Finance:Radio1 DOT1X Building1 802.11g
TRAPEZE\jnespor 172.21.50.42 00:1c:f0:bf:11:a8 alpha-aes MP-Finance:Radio1 DOT1X Building1 802.11ng
SSID: trapezewlan (4)
TRAPEZE\dwu 172.21.52.144 00:1c:26:ac:f2:91 trapezewlan MP-TAC-432:Radio1 DOT1X Building1
jpegueros 172.21.50.105 00:11:f5:05:70:1f trapezewlan MP-Hothouse-432:Ra... DOT1X Building1
TRAPEZE\tash 172.21.50.143 00:0b:7d:26:9d:d7 trapezewlan MP-Hothouse-432:Ra... DOT1X Building1
TRAPEZE\rrose 172.21.50.58 00:1d:e0:90:58:bb trapezewlan MP-CAFE-432:Radio2 DOT1X Building1 802.11na

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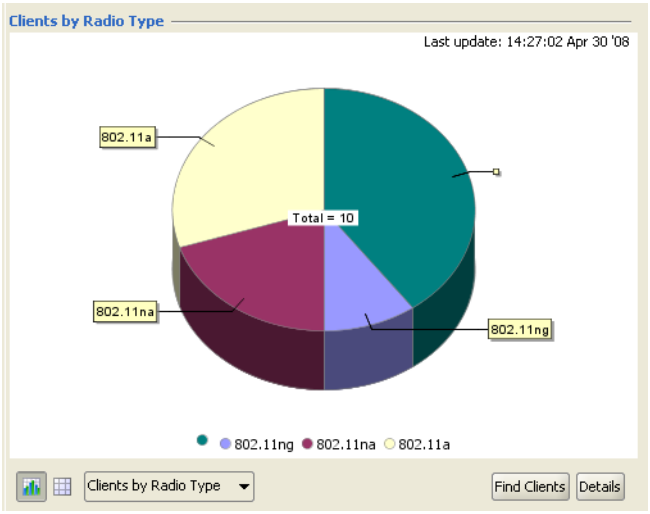
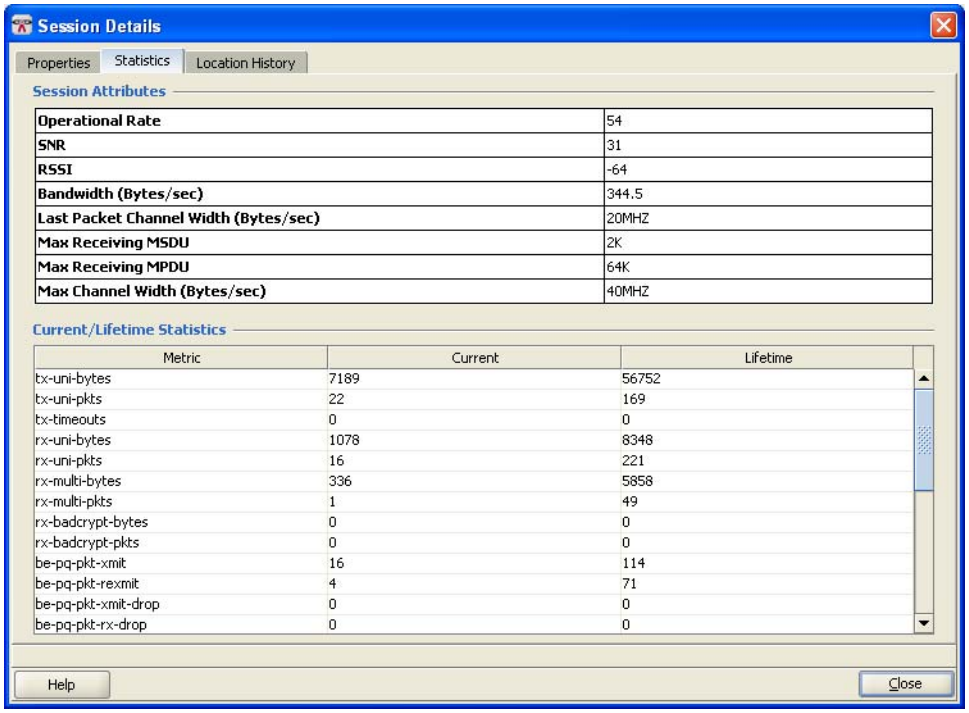
- *RingMaster* provides sorting based on radio type such as 11na and 11ng and identifies them as 11n clients.



- *RingMaster* also provides the following 11n related capabilities for client sessions in the **Client Session Details** dialog:
  - 11n maximum receiving MSDU rate
  - 11n maximum receiving MPDU rate

– 11n maximum channel width



Adding and Monitoring Clients

You can configure RingMaster to monitor specific clients on the network and use the gathered information to troubleshoot client issues on the network.

Using this feature requires an Advanced Monitoring license. Contact Juniper Networks for more information on licensing at http://www.juniper.net/us/en/products-services/wireless/wlm-series

The Client Watched List tracks and displayes historical data for 30 days in a raw format. The data includes the following parameters for the client:

- MAC Address
- Username
- IP Address
- SSID
- Hostname
- Location
- Locale
- Last Updated

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To add a client to the **Client Watch List**, click **Clients**.

1. In the **Tasks** panel, click **View Watched Clients**.
2. In the Tasks panel, click Add Watched Client.
3. Enter the MAC address of the client and click **OK**.
4. The client now appears in the Watched Clients **list**.

Viewing Watched Client Data

To view the collected data for a Watched Client, click **Clients**.

1. In the Tasks panel, under **View**, click **Watched Clients**.
2. On the **Current Status** page, you can view a list of wireless clients placed on **Watched Clients** list.
3. Select a client from the list and then click the **Collected Data** tab to view information about the client.
4. You can view the following information about the client over a specific time period configurable as 1 hour, 24 hours, 7 days, 30 days, 3 months, 6 months, 1 year, or a customized time period.
   - Bandwidth - used bandwidth over a period of time.
   - SNR - Signal to Noise Ratio (SNR)
   - RSSI - Received Signal Strength Indication (RSSI)
   - Last Packet Tx Rate
   - Per Queue TX
   - Per Queue Re-Tx
   - Per Queue Tx Dropped
   - Per Queue Rx Dropped
   - Bytes Tx/Rx
   - Packets Tx/Rx
   - Crypto Errors Rx
   - Calls Accepted/Rejected
   - Client Failures
5. You can also view information about the client using the **Details**, **Events**, and **Locations** tabs. The following information is displayed:
   - Details
     - Start Time
     - Session ID
     - Uptime
     - Username
     - IP Address
     - SSID
     - Hostname
     - VLAN Name

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    - VLAN Source
    - Access Type
    - Auth. Server
    - Auth. Protocol
    - Local Switched
    - Mesh AP
    - TSPEC Voice
    - TSPEC Video
    - SIP State
- Events
    - Start Time
    - Type
    - Session ID
    - Username
    - IP Address
    - SSID
    - Location
    - Auth. Server
    - Auth. Protocol
    - Radio MAC
    - Failure Desc.
    - Failure Reason
    - Auth. Reason
    - IP Change Reason
    - Previous Location
- Locations
    - Start Time
    - Session ID
    - Location
    - Locale
    - MX Serial Number
    - MX IP Address
    - AP Serial Number
    - Module
    - Port
    - AP
    - Radio

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- Direct AP
- Fast Roam

Generating Watched Clients Reports

You can create reports based on the Watched Clients List using the following steps:

1. In the **Tasks** panel, under **Reports**, click **Client Report**.
2. You can filter the sessions by User Name, IP Address, or MAC Address. The default filter is MAC address. After selecting the Filter type, you can add additional filters to apply to the report.
3. On the **Optional: Client Details Report**, select **Include Watched Client Information**.
4. Select the **Report Time Period** and configure the time parameters.
5. Click **Next**.
6. From the **Report Format Options** list, select from HTML, PDF, or XLS.
7. If you want the report e-mailed to you or someone else, enter the e-mail address in the **E-mail Address(es)** field.
8. Select **Copy to FTP Server** to copy the report to your FTP server.
9. Click **Next** to generate the report.

RF Detect Changes

RingMaster supports the following 11n related changes for Rogue Detection in the Security and Alarm Panel:

- *RingMaster* adds radio type information in the security alarm description identifying whether a rogue or suspect device is an 11n capable device. The radio type will also be added to alarm information.

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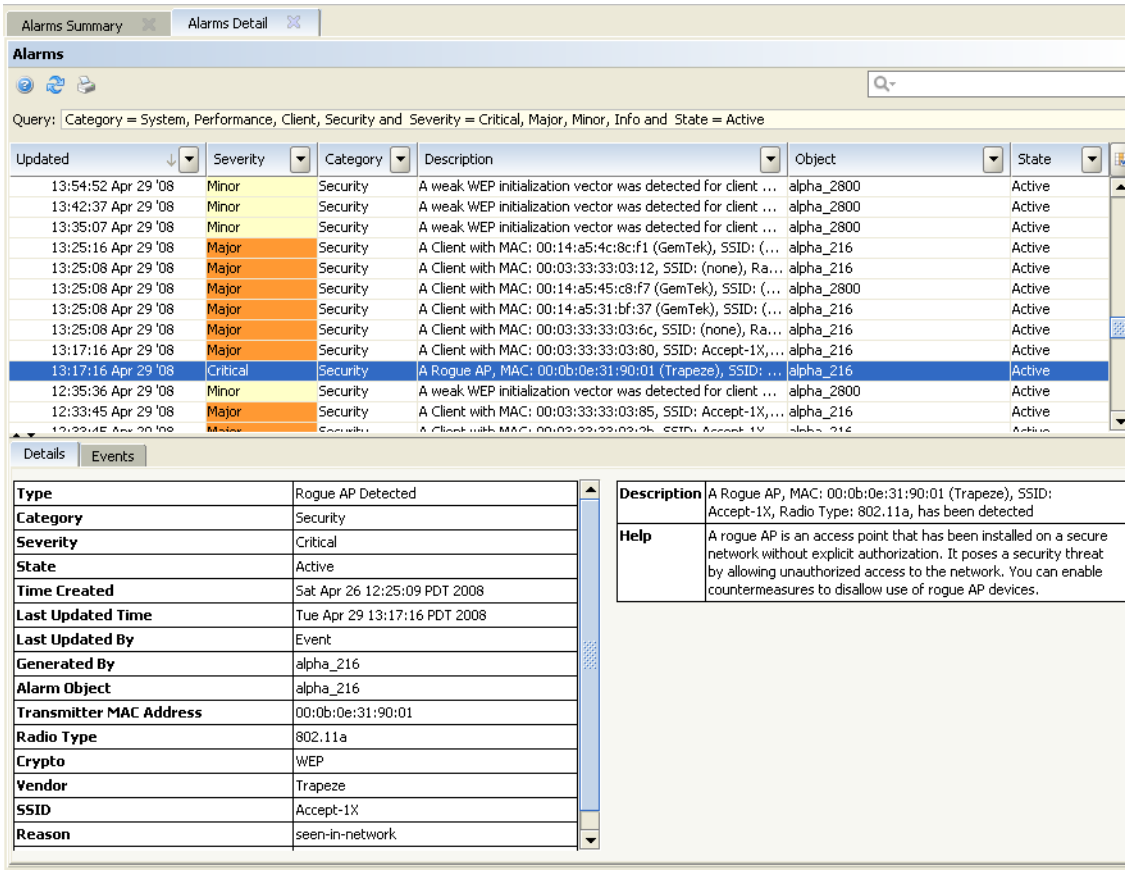
- *RingMaster* adds channel width and secondary channel information to RF Detect listener information data.


Alarms Summary
Alarms Detail
Alarms
Query: Category = System, Performance, Client, Security and Severity = Critical, Major, Minor, Info and State = Active
Updated
Severity
Category
Description
Object
State
13:54:52 Apr 29 '08 Minor Security A weak WEP initialization vector was detected for client ... alpha_2800 Active
13:42:37 Apr 29 '08 Minor Security A weak WEP initialization vector was detected for client ... alpha_2800 Active
13:35:07 Apr 29 '08 Minor Security A weak WEP initialization vector was detected for client ... alpha_2800 Active
13:25:16 Apr 29 '08 Major Security A Client with MAC: 00:14:a5:4c:8c:f1 (GemTek), SSID: (... alpha_216 Active
13:25:08 Apr 29 '08 Major Security A Client with MAC: 00:03:33:33:03:12, SSID: (none), Ra... alpha_216 Active
13:25:08 Apr 29 '08 Major Security A Client with MAC: 00:14:a5:45:c8:f7 (GemTek), SSID: (... alpha_2800 Active
13:25:08 Apr 29 '08 Major Security A Client with MAC: 00:14:a5:31:bf:37 (GemTek), SSID: (... alpha_216 Active
13:25:08 Apr 29 '08 Major Security A Client with MAC: 00:03:33:33:03:6c, SSID: (none), Ra... alpha_216 Active
13:17:16 Apr 29 '08 Major Security A Client with MAC: 00:03:33:33:03:80, SSID: Accept-1X,... alpha_216 Active
13:17:16 Apr 29 '08 Critical Security A Rogue AP, MAC: 00:0b:0e:31:90:01 (Trapeze), SSID: ... alpha_216 Active
12:35:36 Apr 29 '08 Minor Security A weak WEP initialization vector was detected for client ... alpha_2800 Active
12:33:45 Apr 29 '08 Major Security A Client with MAC: 00:03:33:33:03:85, SSID: Accept-1X,... alpha_216 Active
Details
Events
Type Rogue AP Detected
Category Security
Severity Critical
State Active
Time Created Sat Apr 26 12:25:09 PDT 2008
Last Updated Time Tue Apr 29 13:17:16 PDT 2008
Last Updated By Event
Generated By alpha_216
Alarm Object alpha_216
Transmitter MAC Address 00:0b:0e:31:90:01
Radio Type 802.11a
Crypto WEP
Vendor Trapeze
SSID Accept-1X
Reason seen-in-network
Description A Rogue AP, MAC: 00:0b:0e:31:90:01 (Trapeze), SSID: Accept-1X, Radio Type: 802.11a, has been detected
Help A rogue AP is an access point that has been installed on a secure network without explicit authorization. It poses a security threat by allowing unauthorized access to the network. You can enable countermeasures to disallow use of rogue AP devices.

Reports

Due to monitoring changes in AP/Radio Status, Client Session monitoring, and RF Detect monitoring changes, there are corresponding changes to various reports related to these areas.

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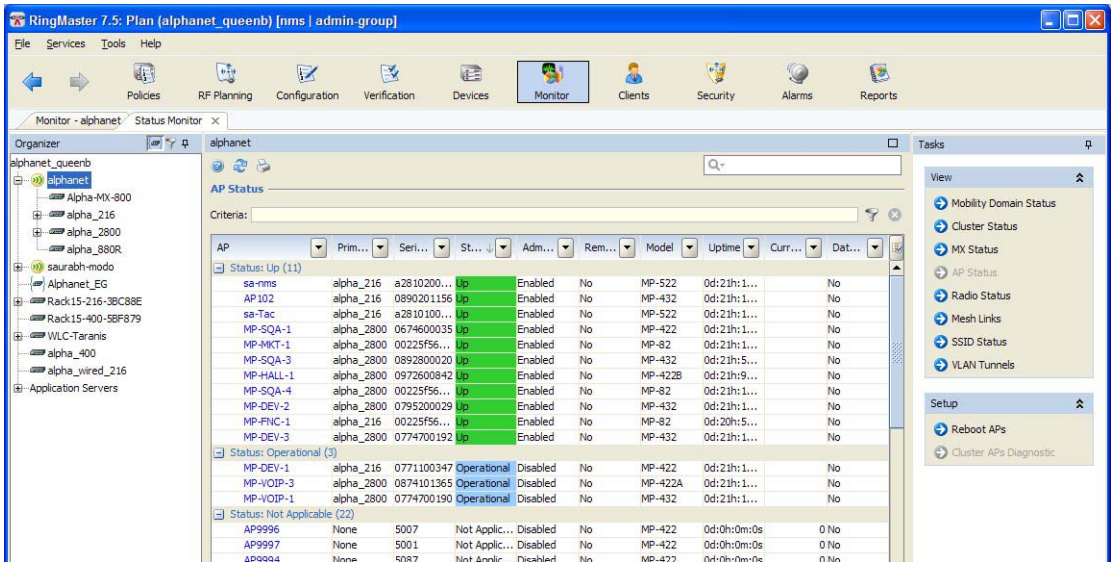
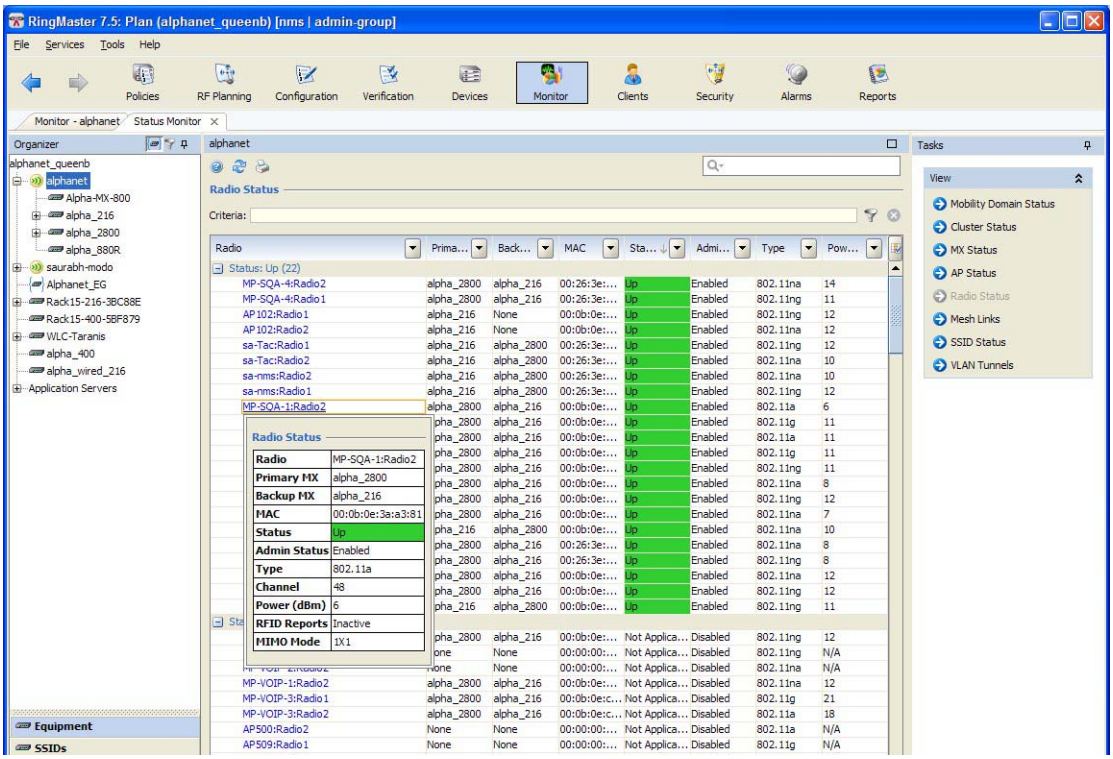
Status Summary Dashboard

The **Status Summary** dashboard is accessed by clicking **Details** in the upper left quadrant of the **Content** panel. When a site name is selected, and the **Equipment** tab at the bottom of the **Organizer** panel is selected, selecting the **Details** button to the right side of the **Status Summary** brings up a window like that shown below:

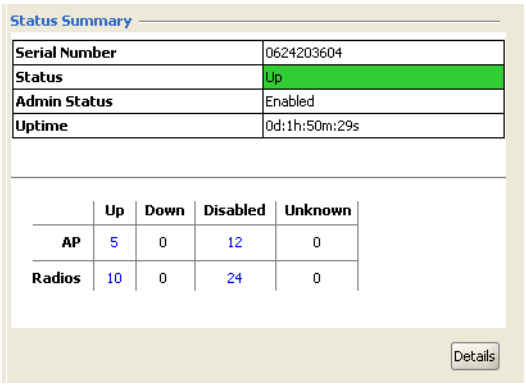


You can pass your cursor over a radio entry (in blue) to see details as shown below:



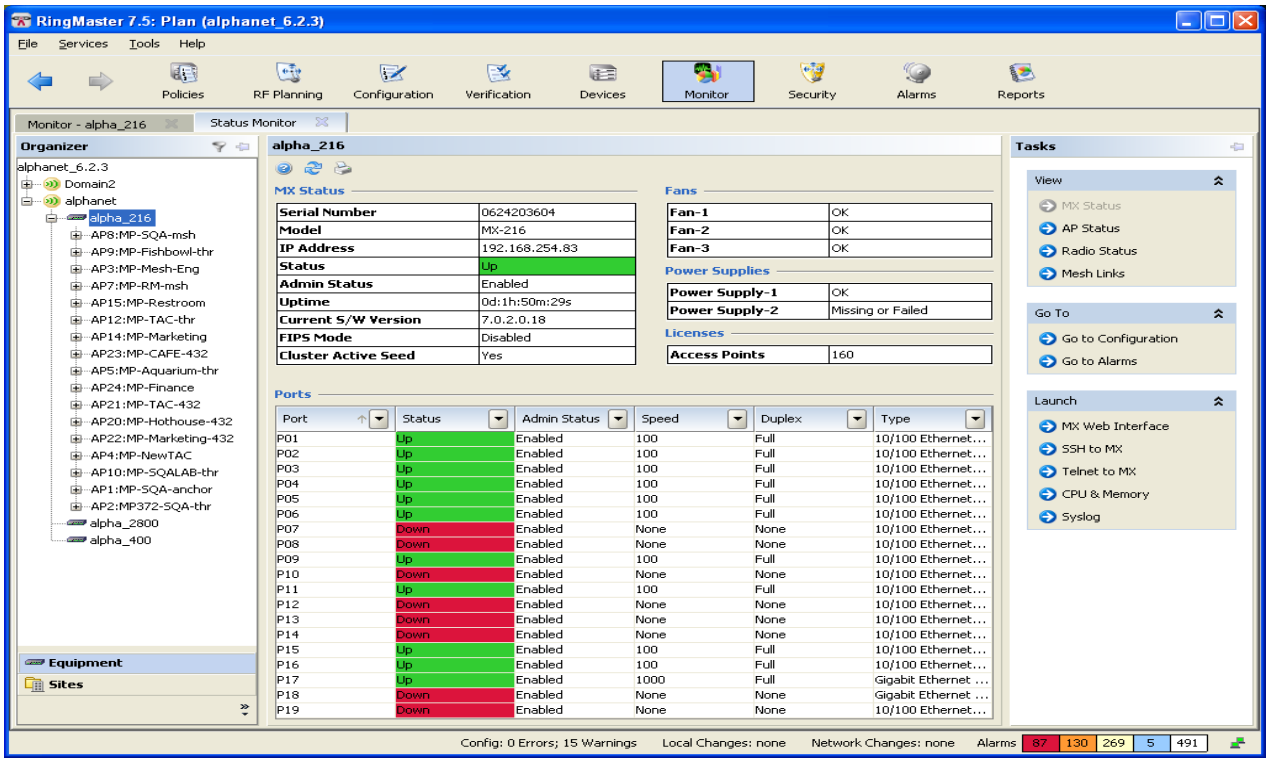
Using the Status Summary View

The **Status Summary** view shows the operational status and property details of equipment such as MXs, AP access points, and AP radios. For example, an MX can show a list of APs or radios, and the information for APs and radios can include the status and other relevant data.



Status Monitor or Status Summary Details

The following screen shows the **Status Monitor** panel after clicking on the **Details** button in the **Status Summary** area.



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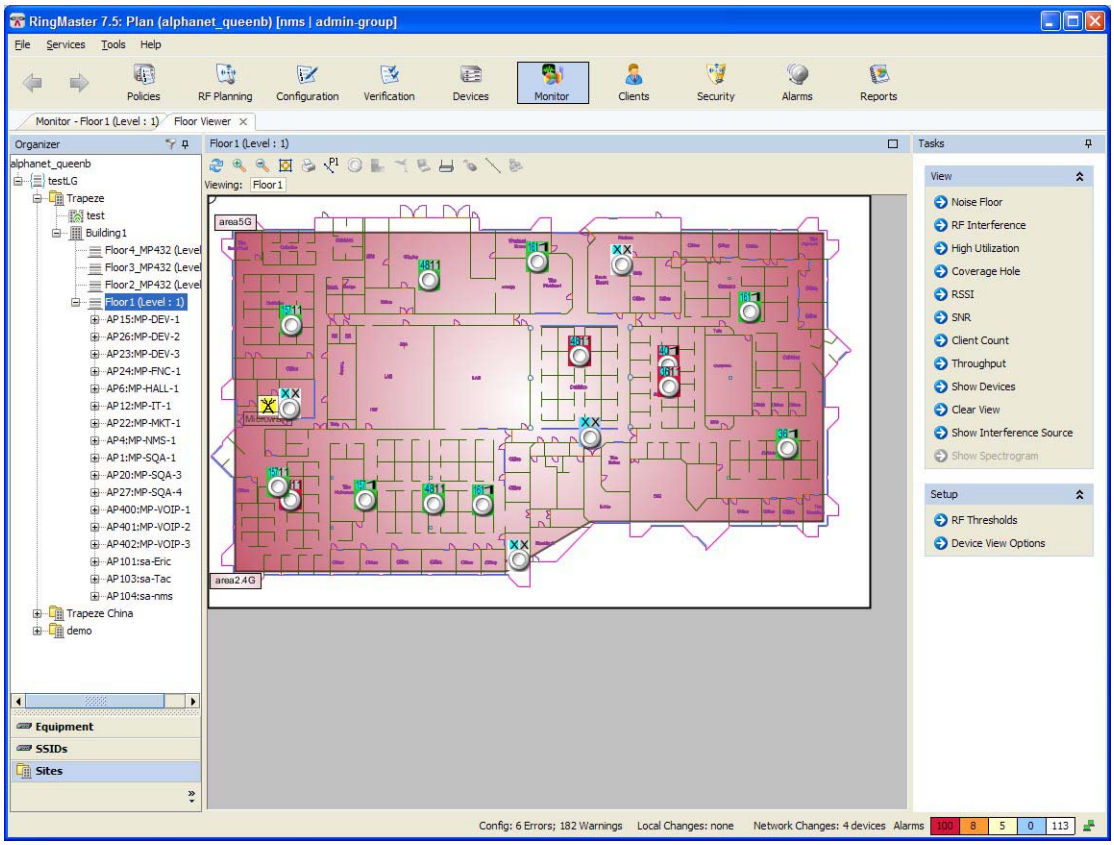
Floor Viewer and Visualizations

You can select an AP access point from a **Monitoring Equipment** tree and display a floor map with an AP selected. From this view, you can generate visualizations of operational statistics such as RSSI, re-transmissions, SNR, and signal level in order to solve problems.

To find an AP on a floor:

1. Click on the **Monitor** button in the main *RingMaster* Navigation Bar.
2. Expand the site list tree in the **Organizer** panel and select an access point you want to view.
3. *RingMaster* automatically opens the **Floor View** panel, displaying a floor map with the selected access point highlighted.



From this window, there are visualization tools available in the **Tasks** panel including:

- **Noise Floor**
- **RF Interference**
- **High Utilization**
- **Coverage Hole**
- RSSI

- SNR
- Client Count
- Throughput
- Show Devices
- Clear View
- Show Interference Source
- **Clear Visualization**

Also in the **Tasks** panel, there is a **Setup** panel option:

- **Setup RF Thresholds**
- Device View Options

Each of these tools is described next.

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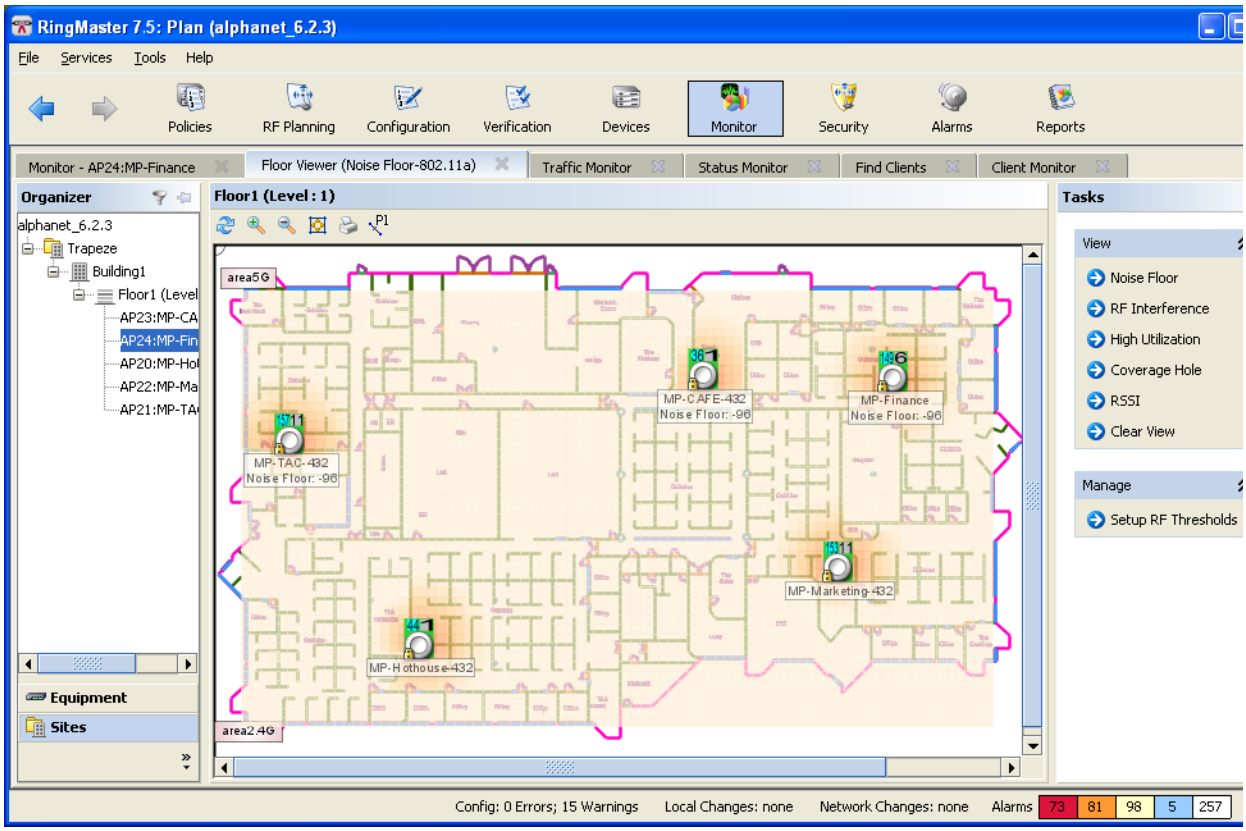
Noise Floor

If you click on **Noise Floor** and select a technology from the list, you see the a progress dialog and then the visualization window shown below:

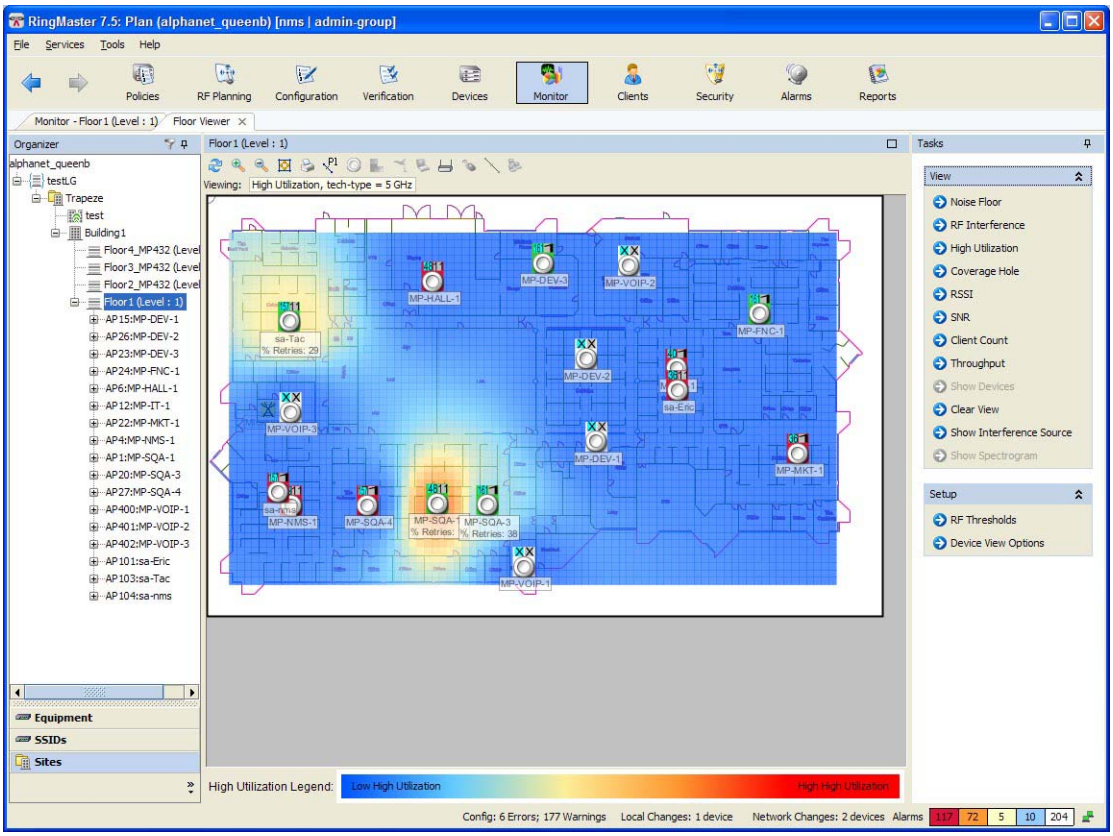


RF Interference

If you click on **RF Interference**, you see a window showing areas where there is RF interference, and if none exists, a message is returned that no interference was located.

High Utilization

If you click on **High Utilization**, you see the following map:



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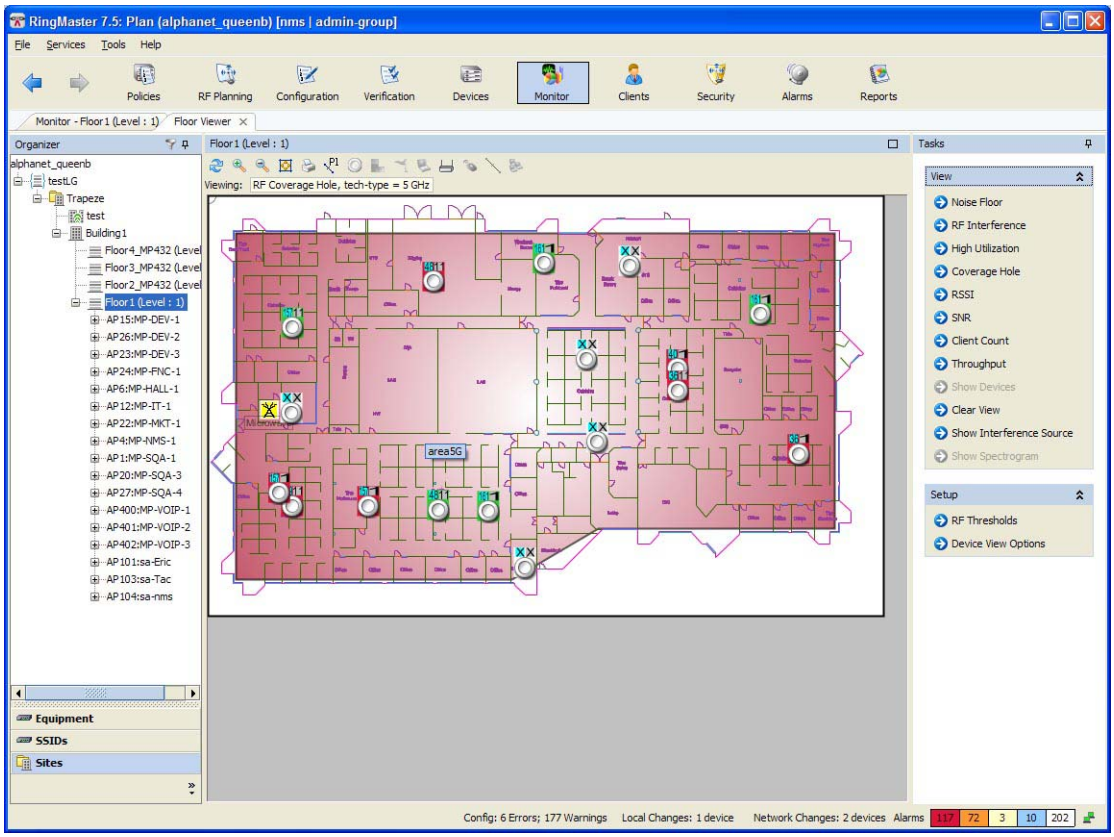
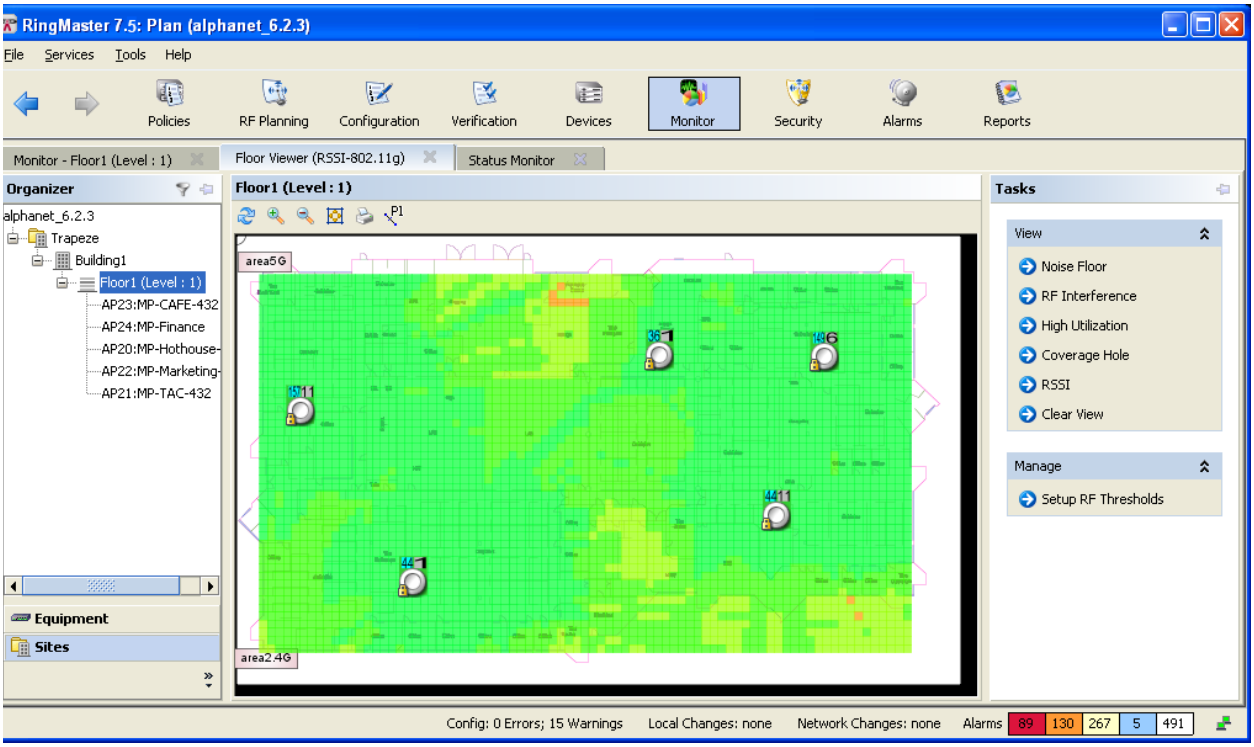
Coverage Hole

If you click on **Coverage Hole**, you see the following window (in this case showing no holes):



RSSI

If you click on **RSSI**, you see the following window:



Clear View

If you click on **Clear View**, floor plan visualizations are cleared.

Setup RF Thresholds

If you click on **Setup RF Thresholds**, you see the following parameters:

- Radio Retransmit Rate (%)
- Radio Noise Floor (dBm)
- Low Radio RSSI (dBm)
- Low Radio SNR (dB)
- Radio Utilization (%)
- Number of Clients per Radio

You can set values, use the **Reset to Default** button to clear changes, click **Cancel** to exit or **OK** to save changes and exit.

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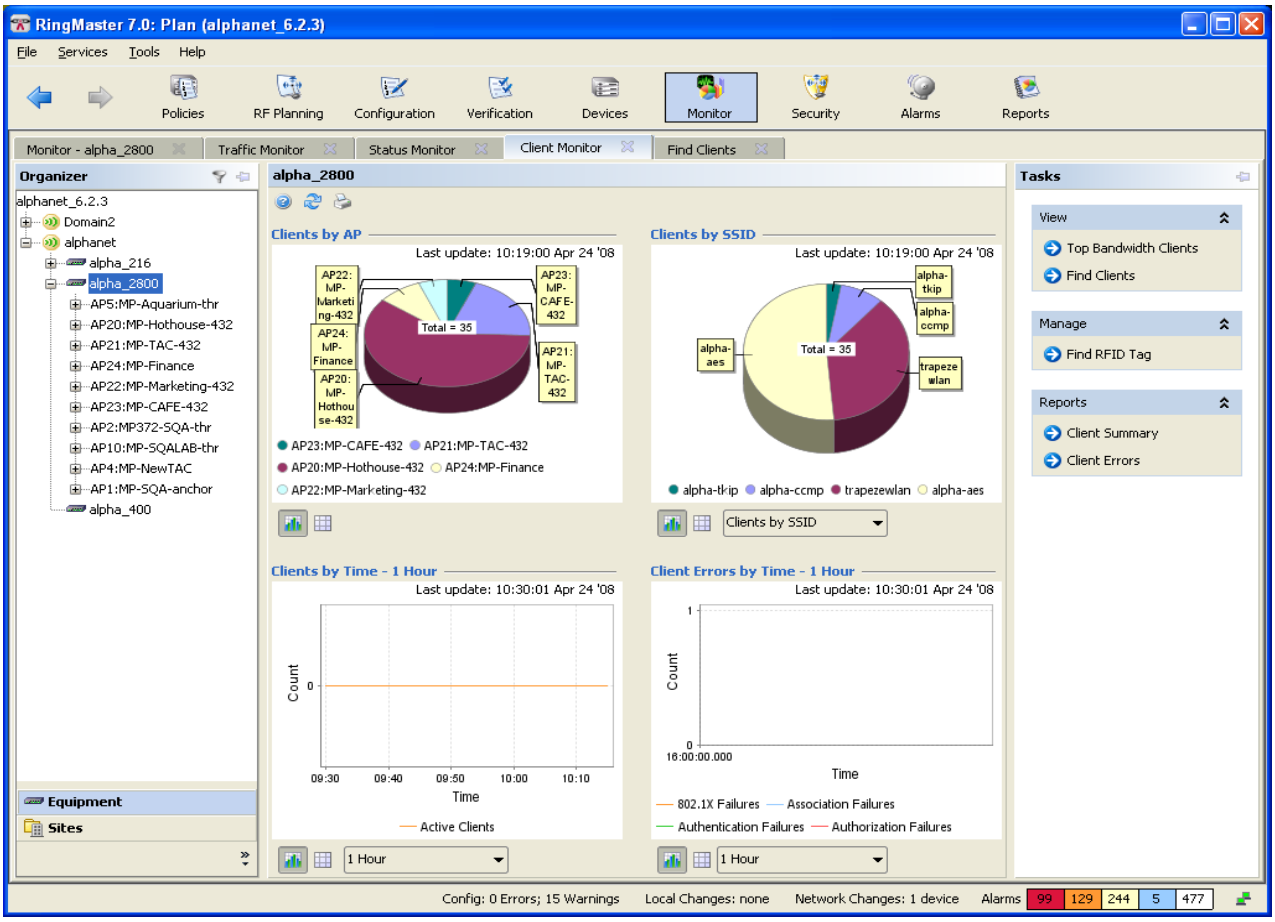
Client Monitor Dashboard

The **Client Monitor** dashboard is accessed by clicking **Details** in the **Content** panel and shows different graphs for clients by **Radio**, **Access Type**, **SSID**, **Radio Type** plus **Traffic** (in various intervals):



In this view, there are **Tasks** panel items including the following:

- **View**
  - **Voice Calls**
  - **Top Bandwidth Clients**
  - **Find Clients**
  - **Watched Clients**
- **Manage**
  - **RFID Tag**
  - **Reports**
  - **Client Summary**

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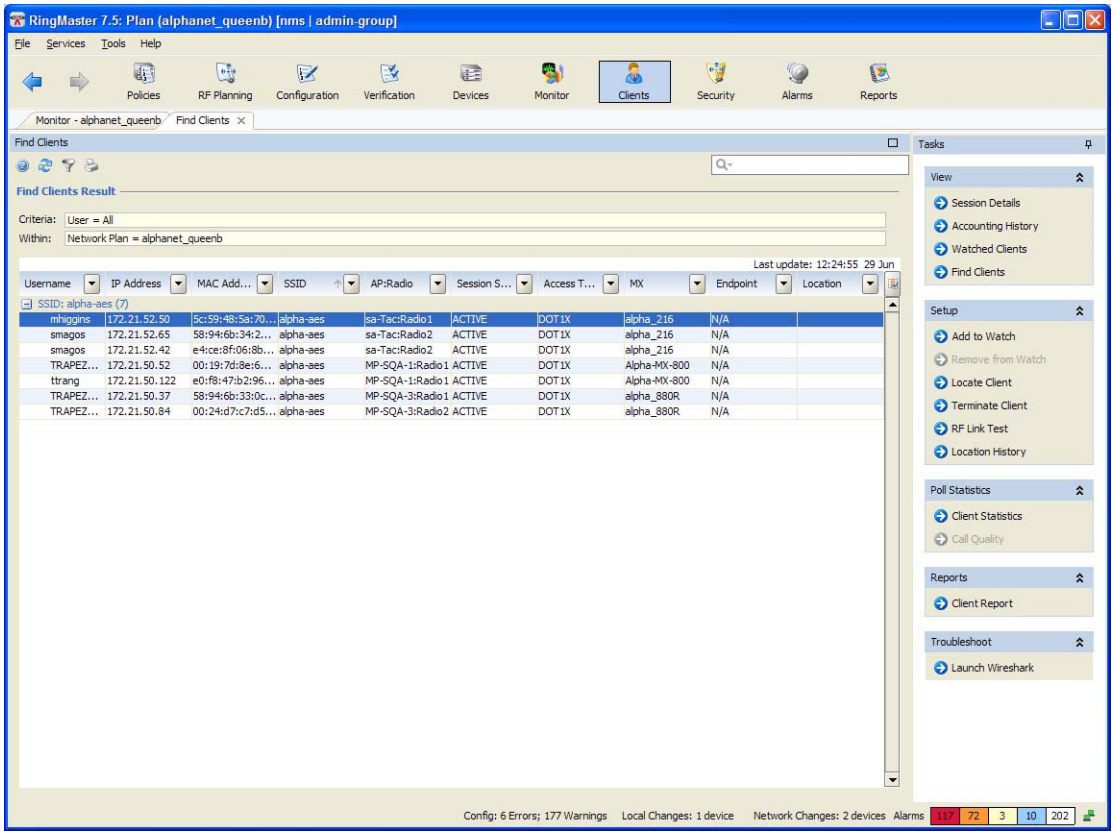
- **Client Errors**

Options are either active or inactive for each item. Some data might not be available depending on scope and server setup options, but you can retrieve and view details of current sessions. Click on an active option to see more information. Inactive options will be gray.

Find Clients Dashboard

More client options are available from the **Find Clients** dashboard. These options under the **Find Clients** tab as shown below:


RingMaster 7.5: Plan (alphanet_queenb) [nms | admin-group]
File Services Tools Help
Policies RF Planning Configuration Verification Devices Monitor Clients Security Alarms Reports
Monitor - alphanet_queenb Find Clients
Find Clients
Find Clients Result
Criteria: User = All
Within: Network Plan = alphanet_queenb
Last update: 12:24:55 29 Jun
Username IP Address MAC Add... SSID AP:Radio Session S... Access T... MX Endpoint Location
SSID: alpha-aes (7)
mhiggins 172.21.52.50 5c:59:48:5a:70... alpha-aes sa-Tac:Radio1 ACTIVE DOT1X alpha_216 N/A
smagos 172.21.52.65 58:94:6b:34:2... alpha-aes sa-Tac:Radio2 ACTIVE DOT1X alpha_216 N/A
smagos 172.21.52.42 e4:ce:8f:06:8b... alpha-aes sa-Tac:Radio2 ACTIVE DOT1X alpha_216 N/A
TRAPEZ... 172.21.50.52 00:19:7d:8e:6... alpha-aes MP-SQA-1:Radio1 ACTIVE DOT1X Alpha-MX-800 N/A
ttrang 172.21.50.122 e0:f8:47:b2:96... alpha-aes MP-SQA-1:Radio1 ACTIVE DOT1X Alpha-MX-800 N/A
TRAPEZ... 172.21.50.37 58:94:6b:33:0c... alpha-aes MP-SQA-3:Radio1 ACTIVE DOT1X alpha_880R N/A
TRAPEZ... 172.21.50.84 00:24:d7:c7:d5... alpha-aes MP-SQA-3:Radio2 ACTIVE DOT1X alpha_880R N/A
Tasks
View
Session Details
Accounting History
Watched Clients
Find Clients
Setup
Add to Watch
Remove from Watch
Locate Client
Terminate Client
RF Link Test
Location History
Poll Statistics
Client Statistics
Call Quality
Reports
Client Report
Troubleshoot
Launch Wireshark
Config: 6 Errors; 177 Warnings Local Changes: 1 device Network Changes: 2 devices Alarms 117 72 3 10 202

In this view, there are **Tasks** panel items including the following:

- View
  - **Session Details**
  - **Accounting History**
  - **Find Clients**
- Manage
  - **Locate Client**
  - **Terminate Client**
  - **RF Link Test**

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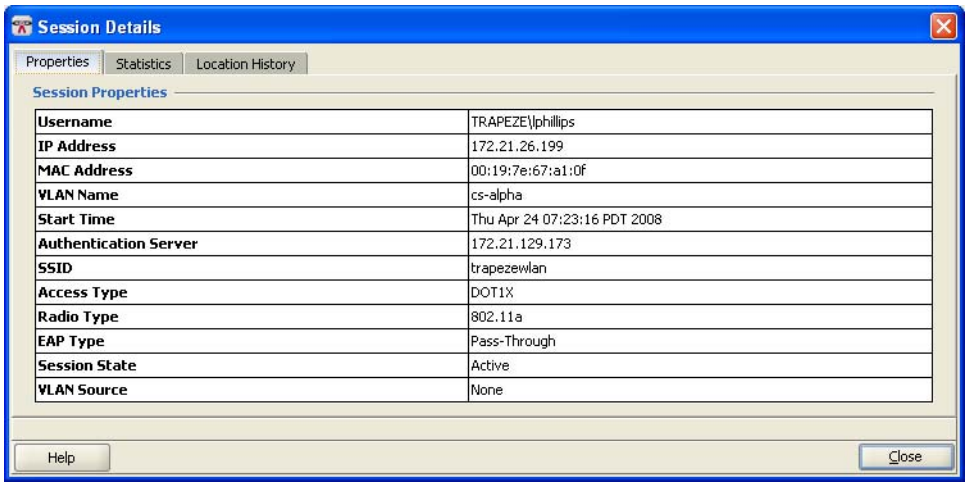
- Poll Statistics
  - **Client Statistics**
- Reports
  - **Client Report**

Options are either active or inactive for each item. Some data might not be available depending on scope and server setup options, but you can retrieve and view details of current sessions. Click on an active option to see more information. Inactive options will be gray.

Session Details

The following screen provides a sample of the **Session Details** option for Clients by MX.



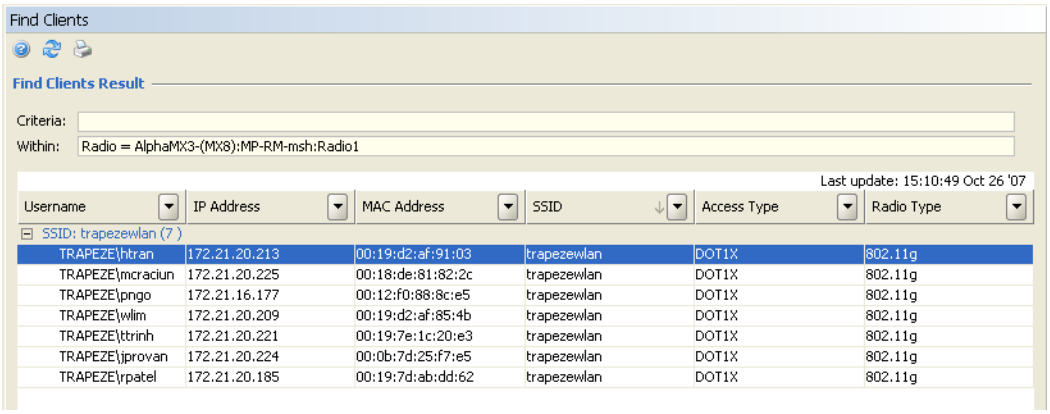
Finding a Client

When the network level polling is disabled, do the following to monitor one or more clients:

1. From the **Client Monitor**, choose **Manage > Find Clients** in the **Task** panel to display the **Find Clients** dialog.

Find Client Results

1. Enter the desired search criteria, select the search scope, and click **Next** to display the **Find Client(s) Result**s.

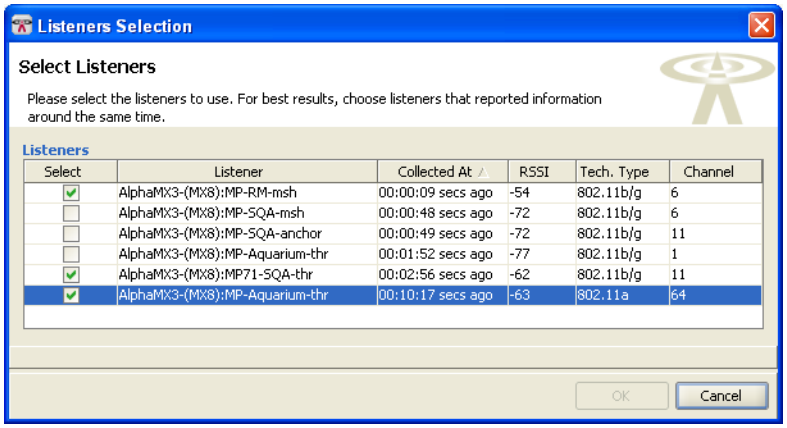


You can access the **Locate Client**, **Terminate Client**, and **RF Link Test** options as well.

Locating A User

Display a user's approximate location by doing the following:

1. On the **Find Client(s) Result** screen, click the **Locate Client** task (under **Manage**). *RingMaster* retrieves information about a client's location and adds an icon on the floor plan.
2. If three or more APs have not detected the client within 15 seconds of each other, the **Select Listeners** dialog box appears, displaying a list of APs that have detected the client. You can select up to six APs from this list. *RingMaster* uses selected APs to calculate the location of a client.


Listeners Selection
Select Listeners
Please select the listeners to use. For best results, choose listeners that reported information around the same time.
Listeners
Select
Listener
Collected At
RSSI
Tech. Type
Channel
AlphaMX3-(MX8):MP-RM-msh 00:00:09 secs ago -54 802.11b/g 6
AlphaMX3-(MX8):MP-SQA-msh 00:00:48 secs ago -72 802.11b/g 6
AlphaMX3-(MX8):MP-SQA-anchor 00:00:49 secs ago -72 802.11b/g 11
AlphaMX3-(MX8):MP-Aquarium-thr 00:01:52 secs ago -77 802.11b/g 1
AlphaMX3-(MX8):MP71-SQA-thr 00:02:56 secs ago -62 802.11b/g 11
AlphaMX3-(MX8):MP-Aquarium-thr 00:10:17 secs ago -63 802.11a 64
OK
Cancel

3. *RingMaster* displays the approximate location of the client on the floor plan. The client's location is indicated with a laptop icon.
4. To refresh the list of APs that detect the client, click the (**Refresh Listeners**) button
5. To change the APs used for calculating the client's location, click the **Listeners** tab and select or deselect APs from the list, then click the (**Locate**) button.

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Refreshing Client Data

RingMaster refreshes client monitor data at regular intervals (every 15 minutes by default). The administrator can specify the refresh rate using the client monitor polling interval. (See **Monitoring Settings**.) Click the **Refresh** icon to refresh data on demand. Counters are incremented each time the *RingMaster Services* receives a client activity trap generated by an MX. Counters represent activity for all clients within the selected scope.

Performing an RF Link Test

Running an RF Link Test can provide a quick, simple summary and breakdown of basic RF statistics for troubleshooting wireless performance problems. When an RF Link Test is started, it sends 20 null data packets from the associated AP to the client.

This returns the following information:

- Number of null data packets sent
- Number of null data packets received and acknowledged
- Transmission time for each null packet
- Indication of signal strength relative to the AP
- Signal-to-noise ratio (SNR)

To perform an RF Link Test:

1. Select a user on the Client(s) Result screen.

   Or

In the **Client Monitor** panel, select a user from the table.

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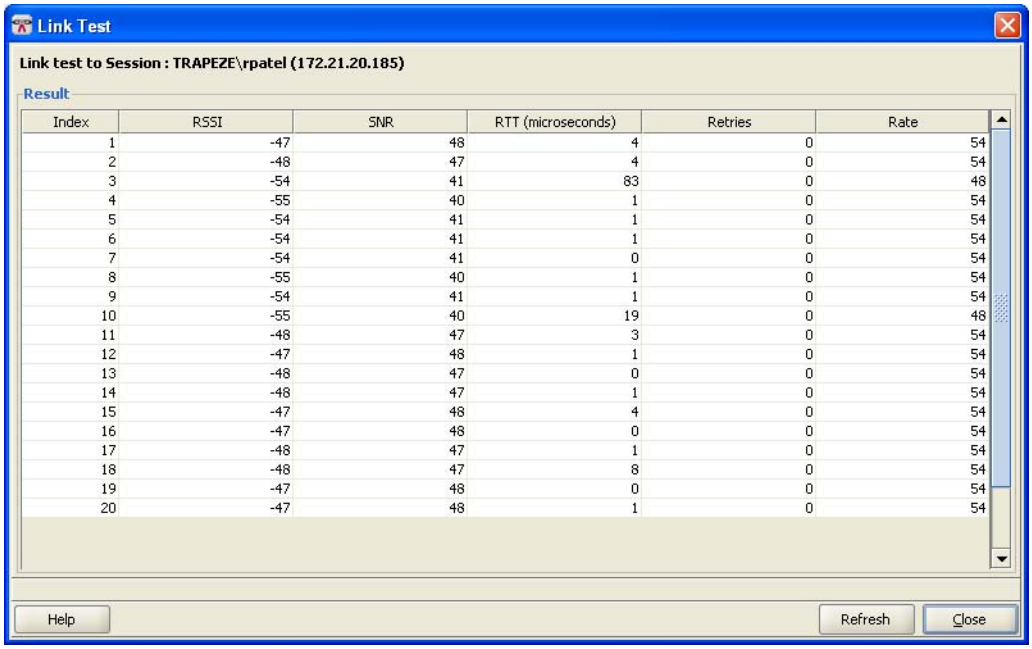
2. Choose **Manage > RF Link Test** in the **Tasks** panel to run a link test and display the **Link Test** results dialog, as shown below.



3. Click the **Refresh** button to perform another link test and repopulate the **RF Link Test** table with new data.

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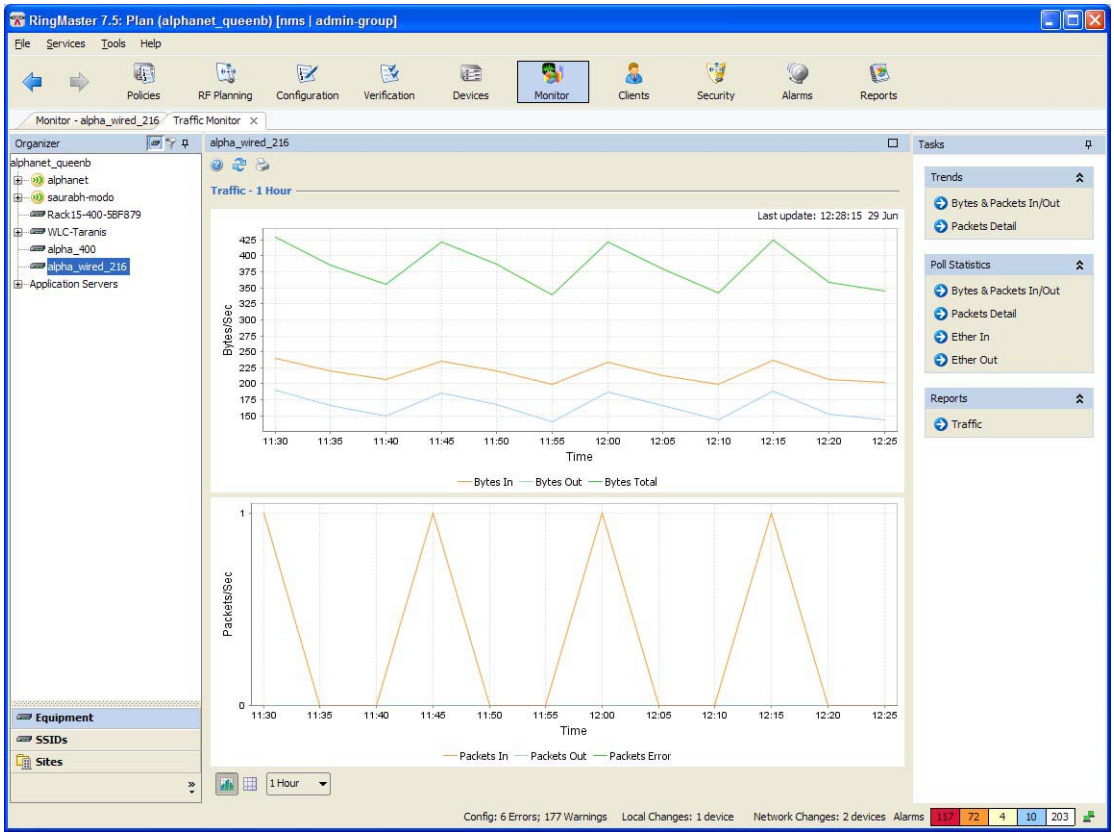
Traffic Monitor Dashboard

The lower right corner of the **Content** panel shows network usage and summary data. If you click on **Details** in this area, you access the **Traffic Monitor** dashboard. *RingMaster* shows bytes and packet counter statistics for the following scopes:



In this view, there are **Tasks** panel items including the following:

- Trends
  - **Throughput**
  - **Noise Floor, SNR & RSSI**
  - **Errors**
- Statistics
  - **Bytes In/Out**
  - **Packets**
  - **Errors**
  - **Rate**
- Reports

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- **Traffic**
- **RF Summary**
- **Radio Details**

Using Traffic Summary View

The **Traffic Summary** view displays network usage and RF summary data. *RingMaster* shows both traffic and RF statistics for Radio, AP, Floor, Building, and Site options, but only traffic data is applicable for MS, Mobility Domain, and Network Plan options. Click the tabular icon or the graph icon to switch between the chart and table views.

The following options are available for MX, Mobility Domain, and Network Plan:

- **1 Hour**
- **24 Hours**
- **7 Days**
- **30 Days**
- **3 Months**
- **6 Months**
- **1 Year**

The following options are available for Radio, AP, Floor, Building, and Site:

- **1 Hour (Radio)**
- **24 Hour (Radio)**
- **7 Days (Radio)**
- **30 Days (Radio)**
- **1 Hour (Traffic)**
- **24 Hour (Traffic)**
- **7 Days (Traffic)**
- **30 Days (Traffic)**

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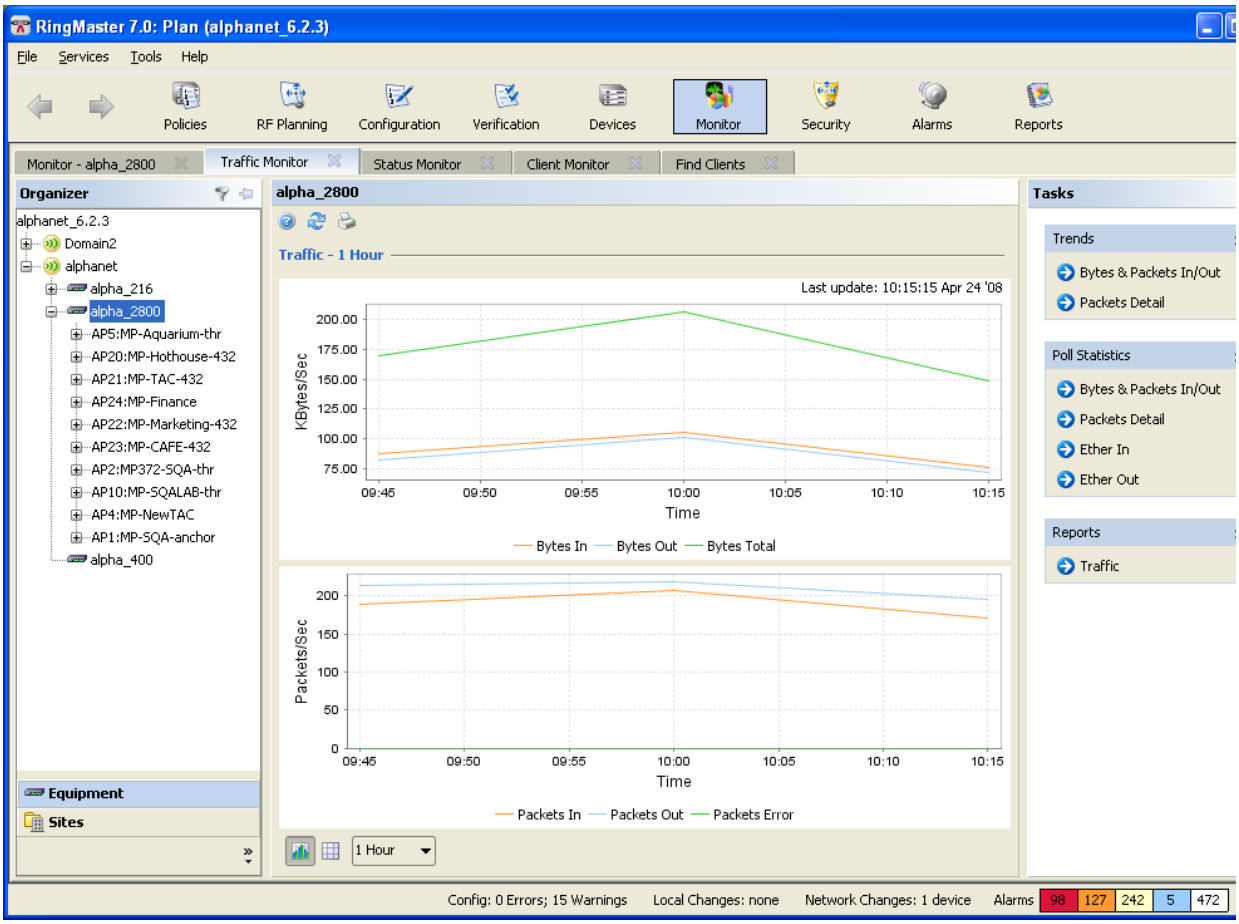
Traffic Details

Click the **Details** button to switch the view from the Traffic Monitor dashboard to the Traffic Details view. The following screen is a sample of the data available for **Traffic - 1 Hour** in **Traffic Monitor** view.



Additional Traffic Options

Additional traffic options are available from the Traffic Monitor dashboard. These options are located on the right side of the screen and include the following:

- **Trends**
  - **Bytes & Packets In/Out**
  - **Packets Detail**

- **Statistics**
  - **Bytes & Packets In/Out**
  - **Packets Detail**
  - **Ether In**

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  - **Ether Out**

- **Reports**
  - **Traffic**

Voice Monitoring with Traffic Views

RingMaster includes monitoring functions that help with voice deployments. QoS statistics — including per-queue Tx and Rx counts — can be accessed via the **Traffic Monitor** dashboard, allowing you to perform real-time monitoring of QoS on a specific radio or client.

On-Demand Statistics Monitoring

Each of the Monitor dashboard views offers a way to see on-demand statistics. For example, selecting a session from the Client Monitor panel launches the current statistics for that session.

Viewing Performance Data

RingMaster opens a separate window for the statistics panel, and you can open multiple statistics panels. You can keep the windows separate, or group multiple statistic windows together by dragging them across the windows.

Monitoring Individual Users

If an individual user notifies you that the network is very slow or inaccessible, perform the following steps to identify the problem:

1. Find the user in the list of users on the network.
2. Locate the user on the floor plan. (If you can locate them, then the problem scope can be narrowed to performance.)
3. View the network activity of the user.
4. View network performance statistics for the user session.

Finding a User

You can find a user or multiple users based on the following criteria:

- **Username**
- **IP address**
- **MAC address**
- **VLAN name**

To find a user:

1. Click on the **Monitor** button on the main *RingMaster* Navigation Bar.

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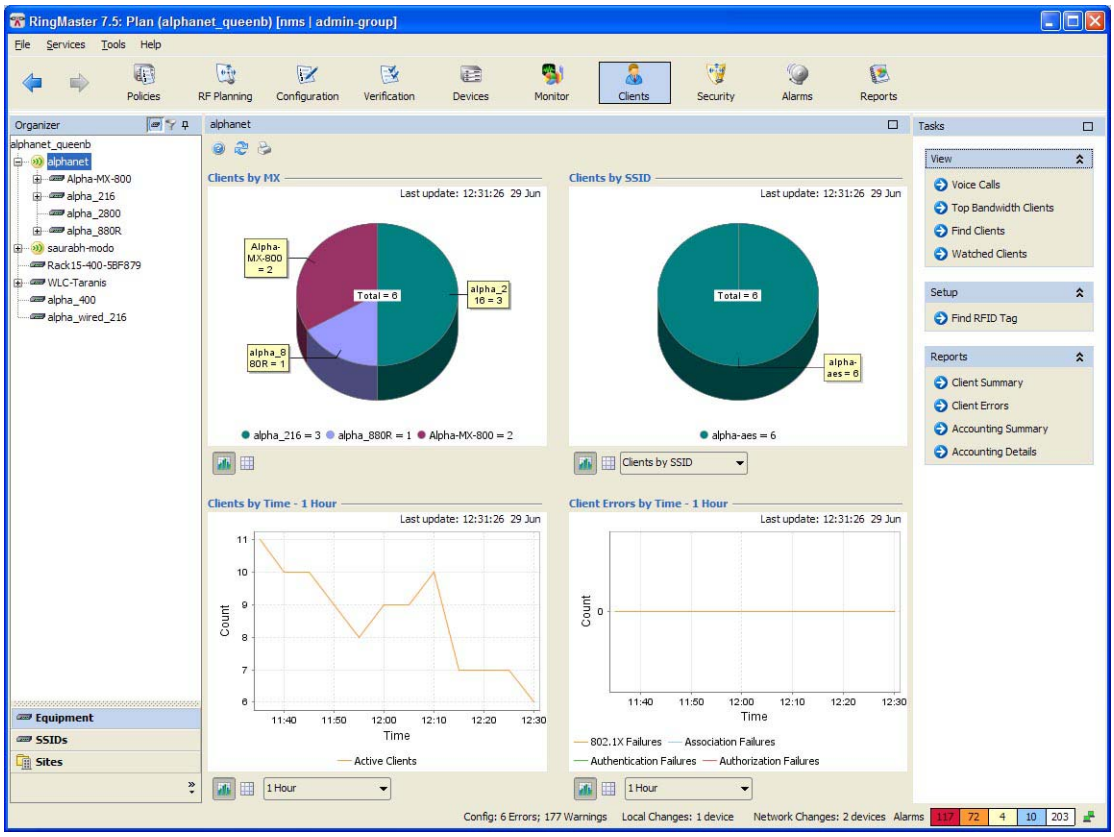
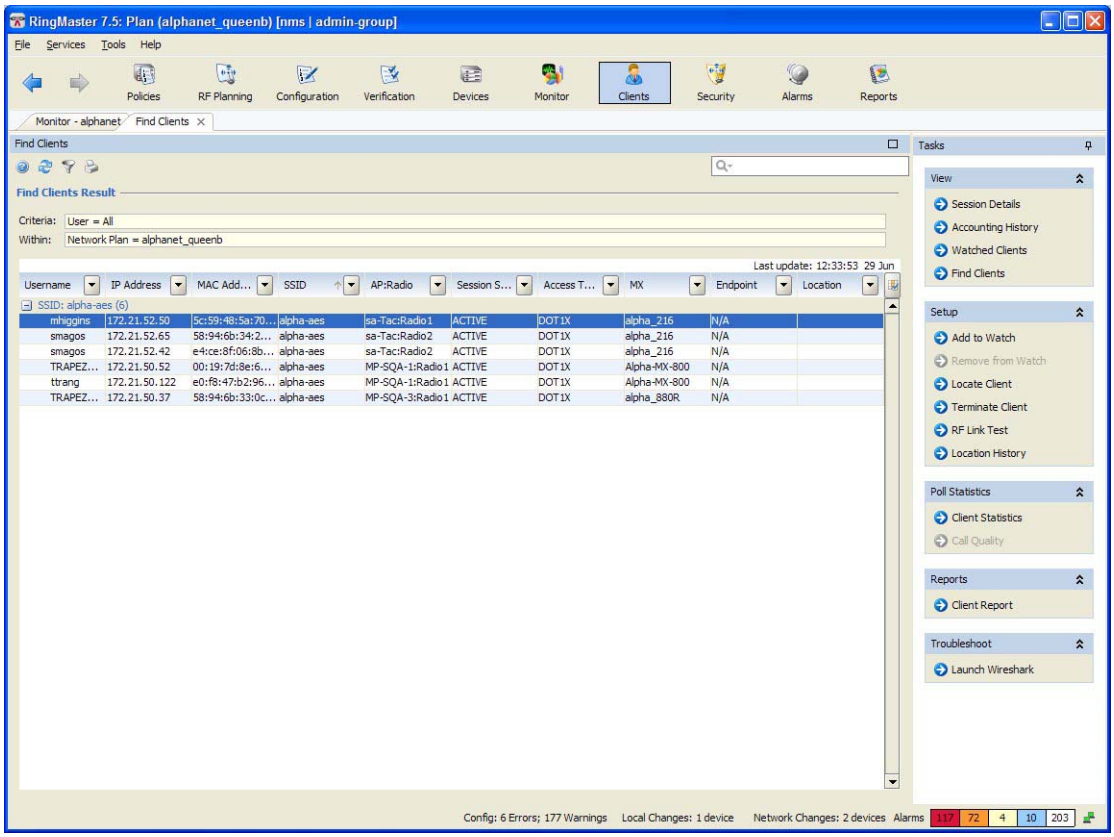
2. Click **Details** in the **Client Summary View** to switch to the **Client Monitor View**.



3. Click **Find Clients** under the **Manage** section of the **Tasks** panel. The **Find Clients** dialog box appears is displayed.
4. Enter the desired search criteria, and search scope. Click **OK**.

RingMaster displays search results.


RingMaster 7.5: Plan (alphanet_queenb) [nms | admin-group]
File Services Tools Help
Policies RF Planning Configuration Verification Devices Monitor Clients Security Alarms Reports
Monitor - alphanet Find Clients
Find Clients
Find Clients Result
Criteria: User = All
Within: Network Plan = alphanet_queenb
Last update: 12:33:53 29 Jun
Username IP Address MAC Add... SSID AP:Radio Session S... Access T... MX Endpoint Location
SSID: alpha-aes (6)
mhiggins 172.21.52.50 5c:59:48:5a:70... alpha-aes sa-Tac:Radio1 ACTIVE DOT1X alpha_216 N/A
smagos 172.21.52.65 58:94:6b:34:2... alpha-aes sa-Tac:Radio2 ACTIVE DOT1X alpha_216 N/A
smagos 172.21.52.42 e4:ce:8f:06:8b... alpha-aes sa-Tac:Radio2 ACTIVE DOT1X alpha_216 N/A
TRAPEZ... 172.21.50.52 00:19:7d:8e:6... alpha-aes MP-SQA-1:Radio1 ACTIVE DOT1X Alpha-MX-800 N/A
ttrang 172.21.50.122 e0:f8:47:b2:96... alpha-aes MP-SQA-1:Radio1 ACTIVE DOT1X Alpha-MX-800 N/A
TRAPEZ... 172.21.50.37 58:94:6b:33:0c... alpha-aes MP-SQA-3:Radio1 ACTIVE DOT1X alpha_880R N/A
Tasks
View
Session Details
Accounting History
Watched Clients
Find Clients
Setup
Add to Watch
Remove from Watch
Locate Client
Terminate Client
RF Link Test
Location History
Poll Statistics
Client Statistics
Call Quality
Reports
Client Report
Troubleshoot
Launch Wireshark
Config: 6 Errors; 177 Warnings
Local Changes: 1 device
Network Changes: 2 devices
Alarms 117 72 4 10 203

You can display a user's approximate location as follows:

1. On the **Find Clients Result** screen, click **Locate Client** (under **Manage**). *RingMaster* retrieves information about the location.
2. If three or more APs have not detected a client within 15 seconds, the **Listeners Selection** dialog box appears, displaying a list of APs that have detected the client. You can select up to six APs from the list. *RingMaster* uses selected APs to calculate the location of a client.

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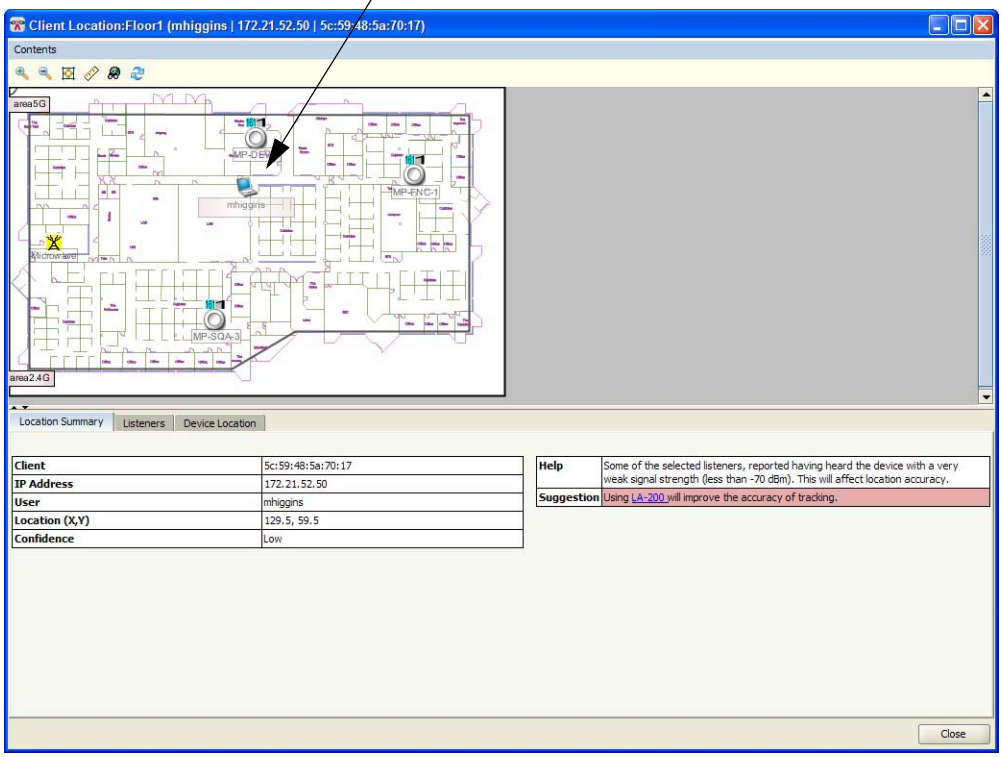
3. *RingMaster* displays the approximate location of a client on the floor plan. The location of the client is indicated with a laptop icon, as shown below.

Located Client



4. To refresh the list of APs that detect a client, click the (**Refresh Listeners**) button. To change the APs used for calculating the location of a client, click the **Listeners** tab and select or deselect APs from the list, then click the (**Locate**) button.

Displaying User Activity

You can display event types recorded for a user. Disassociation events can occur, and users dropped from a network. These events can indicate a reason why access is barred or performance is slow for a user. For example, authorization failures occur if a local database or RADIUS server fails to recognize a user.

To display user activity:

1. On the **Find Clients** screen, click the **Session Details** task (under **View**). *RingMaster* retrieves information about a client session.

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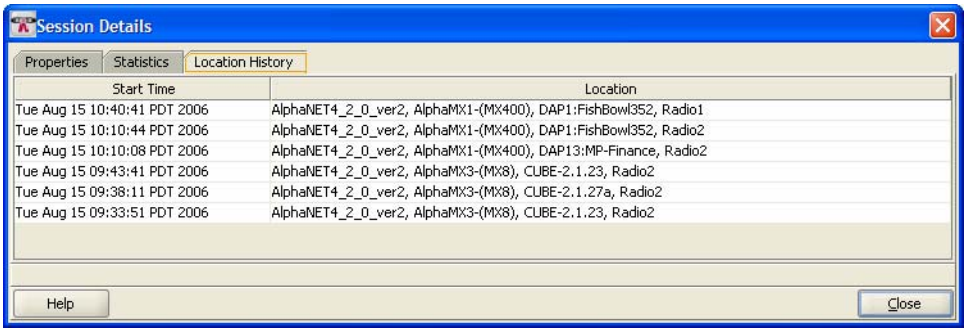
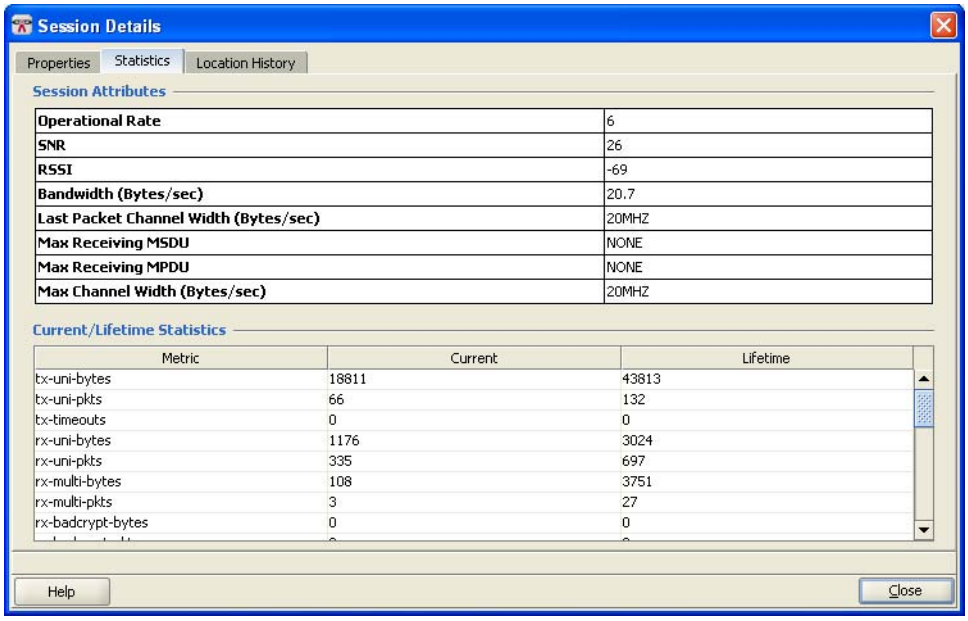
2. Select the **Location History** tab to see where a user has been. From here, you can determine the areas in a WLAN where there is interference.



3. Select the **Statistics** tab to display current and lifetime statistics for the user.



Operational rate statistics display throughput per second.

The following throughput rates are optimum:

- **802.11b** — 11 Mb/s (optimum)
- **802.11g/a** — 36 Mb/s or higher

Signal to Noise Ratio (SNR) statistics can help you determine whether the interference is being created by too much noise on a channel. Receive Signal Strength (RSSI) statistics can indicate whether a low signal strength is creating the user's performance problem. A high number of Transmit Timeouts (tx-timeouts) can indicate interference problems.

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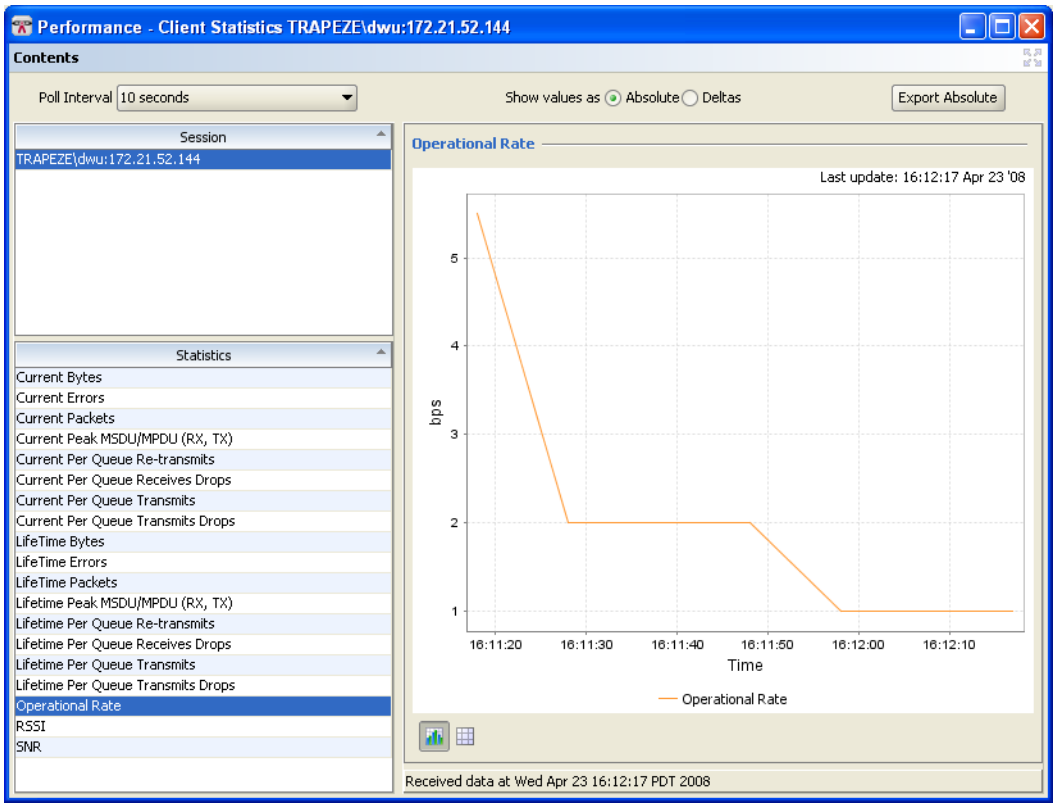
View User Performance Statistics

If an issue cannot be traced to a specific problem based on current activity, you can view statistics over a period of time.

To view user performance statistics:

1. Click on the **Monitor** button on the main *RingMaster* Navigation Bar.
2. Click **Details** in the **Client Summary View** to move to the **Client Monitor View**.
3. In the table of **Client Sessions** in the **Content** panel, select a user session, then click **Client Statistics** in the **Task Panel** to display the **Performance - Client Statistics...** dialog.



4. From the **Poll Interval** list, you can select how often *RingMaster* collects specified statistics for a user.

Monitoring a Group of Users

If a group of users in a specific area of a floor say they are experiencing poor performance, target a radio or radios those users are associating with and view performance statistics and trends for just those radios.

To view performance statistics for an individual radio:

1. Click on the **Monitor** button on the main *RingMaster* Navigation Bar.

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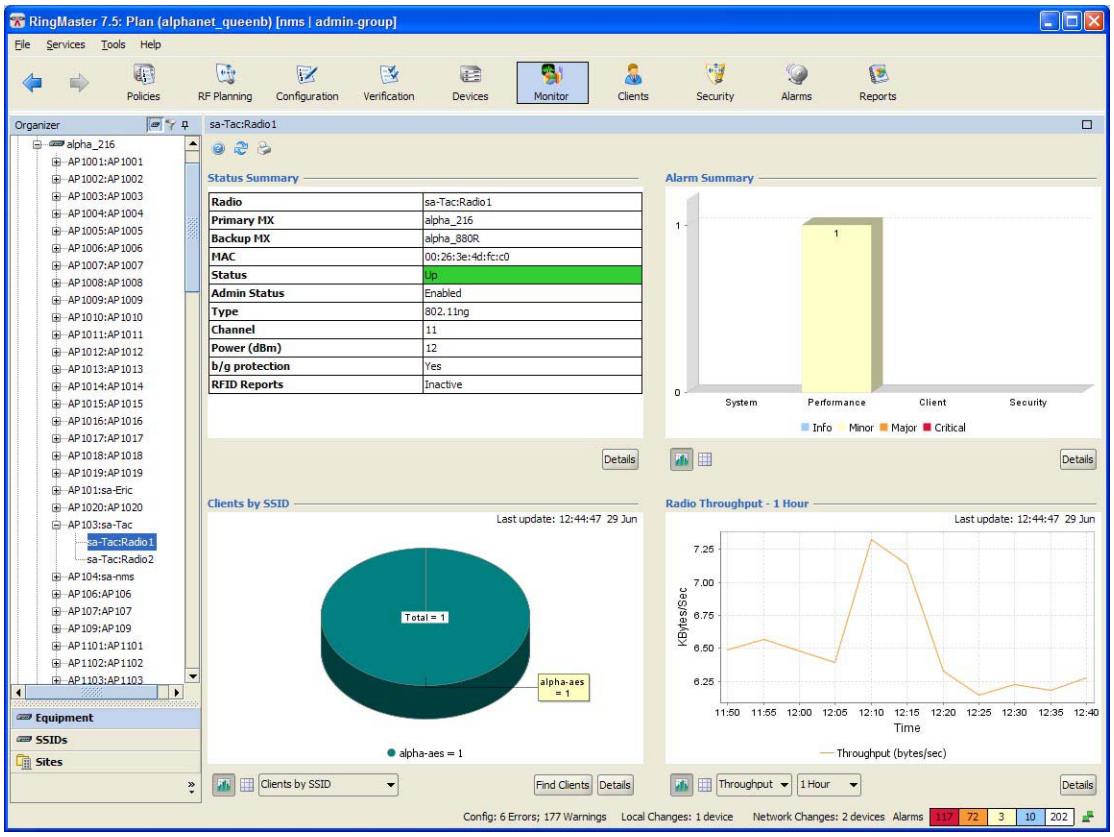
2. Expand the **Equipment** list in the **Organizer** panel, and select a radio. Monitor views display summary information for a selected radio.



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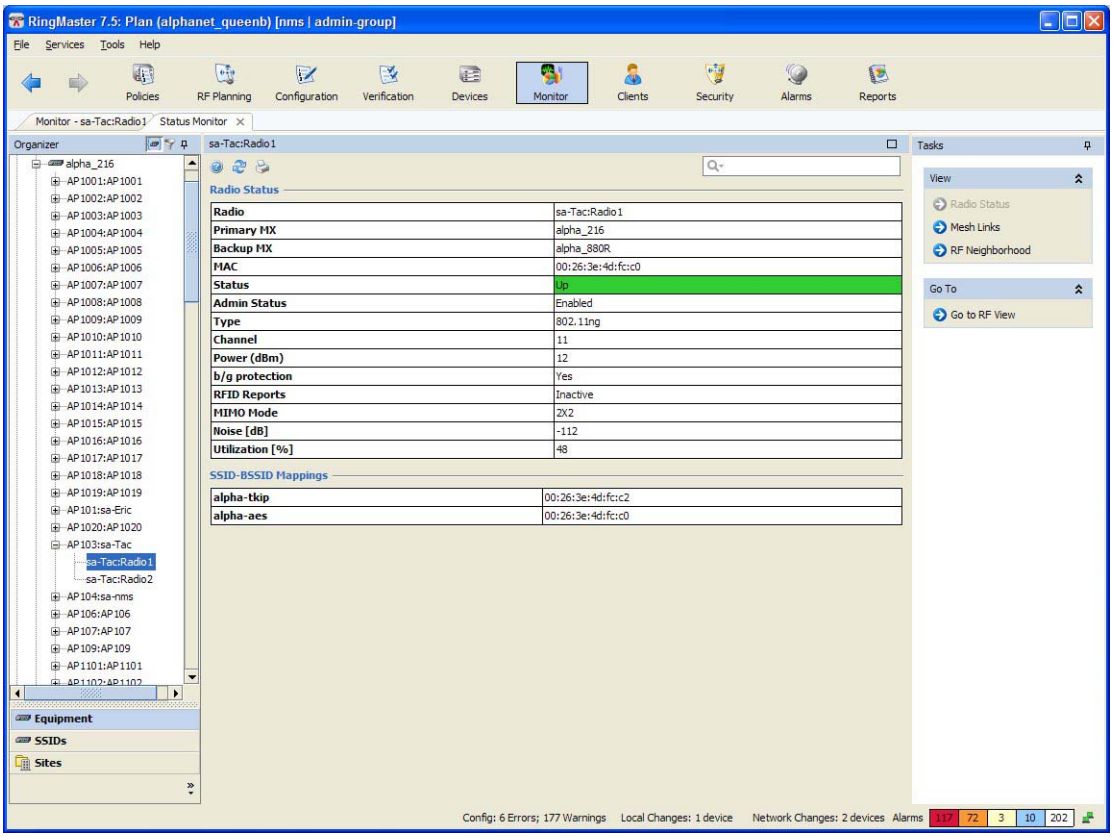
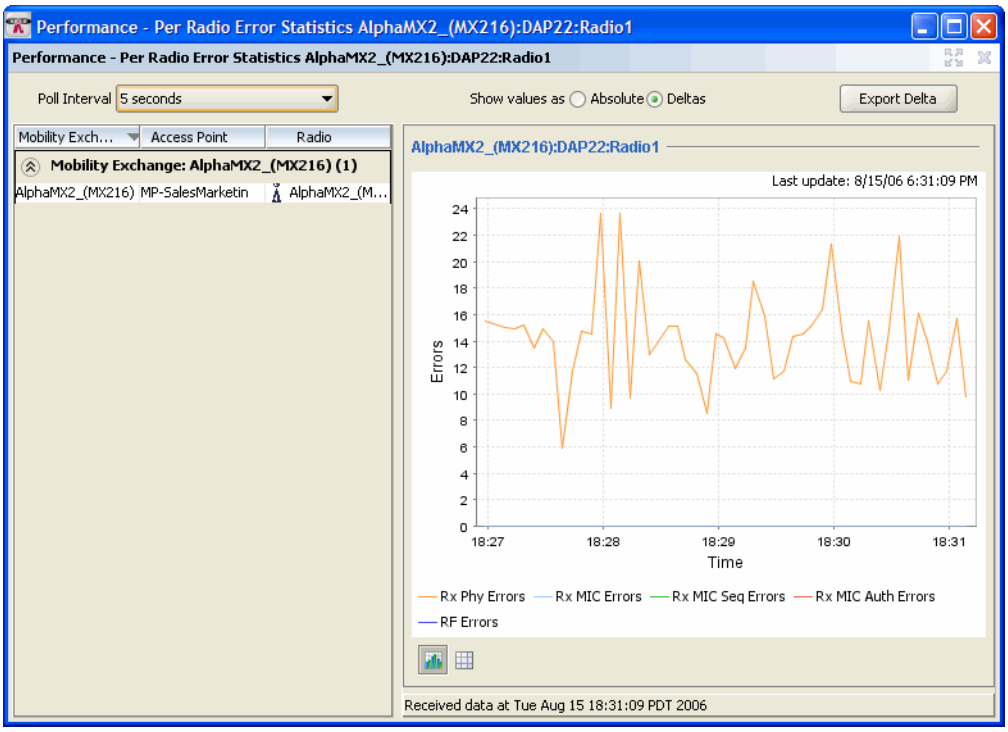
3. Click **Details** in the **Traffic Summary View** to move to a **Radio Status** view.



4. Click on an option under **Statistics** in the **Task Panel** to display the **Performance - Per Radio Error Statistics** dialog for a radio. In the example below, error statistics are displayed.



To view RF trends for an individual radio:

1. Click on the **Monitor** button on the main *RingMaster* Navigation Bar.
2. Expand the **Equipment** list in the **Organizer panel**, and select a radio to display the Monitor views for a radio.
3. Click **Details** in the **Traffic Summary View** to switch to the **Radio Monitor View**.

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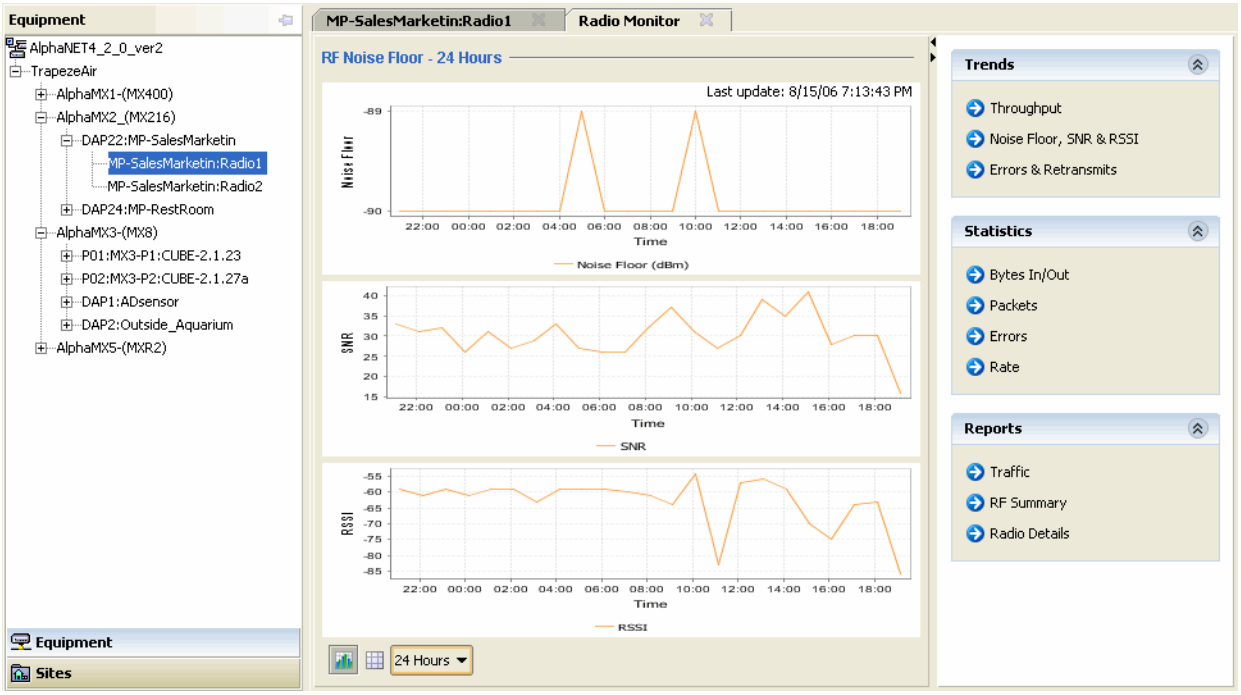
4. Click on one of the options under **Trends** in the **Tasks** panel to display trend information for a radio. Selected trend information is displayed in the **Content** panel. In the example below, trends for Noise Floor, SNR, and RSSI over the past 24 hours are displayed.



Finding an AP on a Floor

Before implementing a wireless network, configure a floor plan that uses RF Planning and Location. You can select an AP access point from the **Monitoring** Equipment tree and display a floor map with that AP selected. From this view, you can generate visualizations of operational statistics such as RSSI, re-transmits, SNR, and signal level to determine problem areas.

To find an AP on the floor:

1. Click on the **Monitor** button in the main *RingMaster* Navigation Bar.
2. Expand the **Site** list in the **Organizer panel** and select the access point to view.
3. *RingMaster* automatically opens the **Floor Viewer** panel displaying a floor map with the selected access point highlighted.
4. Select a statistic from the **Task panel** to generate a topographical visualization of that data. (If you choose the RF Interference, High Utilization, or Coverage Hole options and re-transmit rates within the depicted area that do not exceed 10% of total network bytes, *RingMaster* displays a message dialog instead of generating a visualization.) In the example below, the selected access point is highlighted and RSSI for the coverage area is depicted in the **Floor Viewer**.

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Optimize your network by importing RF measurement data to correct RF attenuation obstacle information if you have a reported coverage area problem or if you want to verify your RF network coverage. For more information about optimizing your network plan, refer to “Optimizing a Network Plan” in the publication *RingMaster Planning Guide*.

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Managing Alarms

Fault Management is a feature included in *RingMaster* to manage faults in a network. A *fault* is reported as an *alarm* generated by a *trap*, *rule*, *status*, or *threshold- exceeded* event. This system monitors traps from Trapeze and OEM devices. It monitors traps from third-party applications and adds new trap support when necessary. The type of traps and their IP sources determine how new traps correlate with existing traps.

Alarm Management

An alarm is generated by a trap, a network verification rule, a status or a threshold exceeded event. There is a one or many to one mapping between faults and the traps/events. Besides monitoring traps from Trapeze and OEM devices, *RingMaster* fault management provides standard traps and traps for third party APs. An interface is provided for adding new trap support. These traps will be correlated based on the type and the source IP only.

In this document, **Fault** and **Alarm** are used interchangeably

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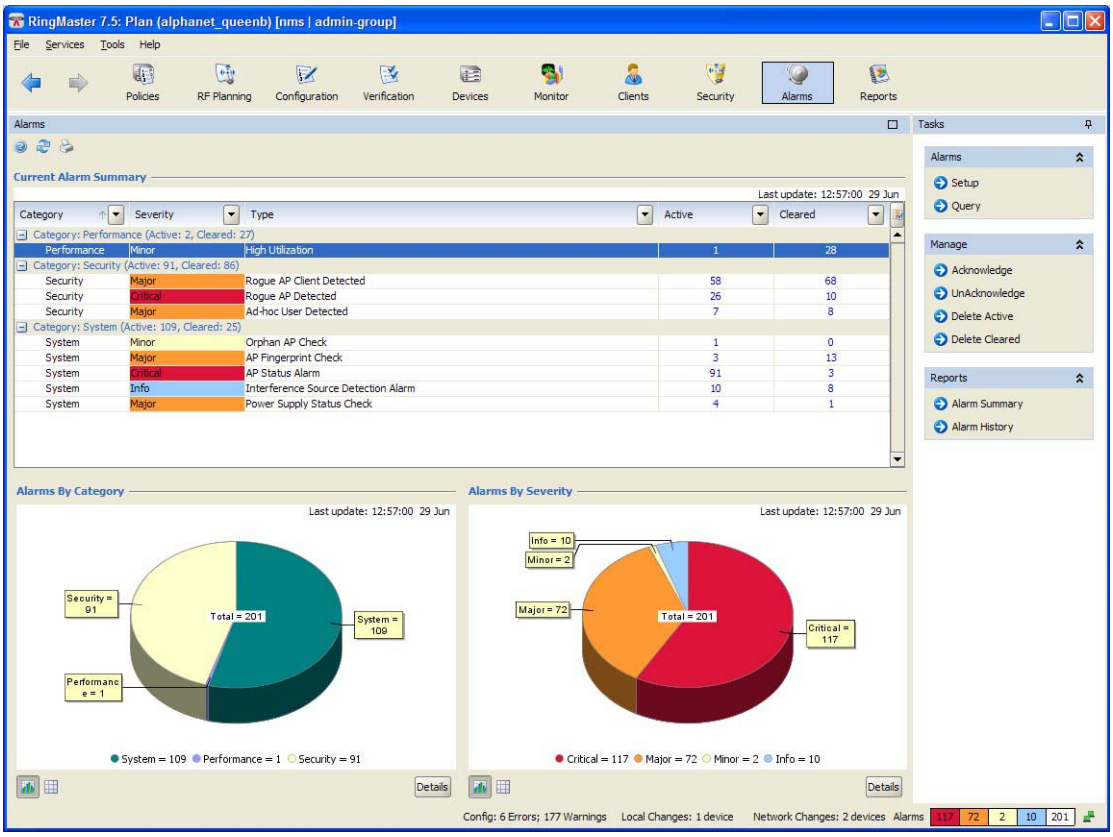
Alarms Summary Window

The **Alarm Summary** view shows alarms organized by category, severity and alarm type.


RingMaster 7.5: Plan (alphanet_queenb) [nms | admin-group]
File Services Tools Help
Policies RF Planning Configuration Verification Devices Monitor Clients Security Alarms Reports
Alarms
Current Alarm Summary
Last update: 12:57:00 29 Jun
Category Severity Type Active Cleared
Category: Performance (Active: 2, Cleared: 27)
Performance Minor High Utilization 1 28
Category: Security (Active: 91, Cleared: 86)
Security Major Rogue AP Client Detected 58 68
Security Critical Rogue AP Detected 26 10
Security Major Ad-hoc User Detected 7 8
Category: System (Active: 109, Cleared: 25)
System Minor Orphan AP Check 1 0
System Major AP Fingerprint Check 3 13
System Critical AP Status Alarm 91 3
System Info Interference Source Detection Alarm 10 8
System Major Power Supply Status Check 4 1
Alarms By Category
Last update: 12:57:00 29 Jun
Security = 91
Total = 201
System = 109
Performance = 1
System = 109 Performance = 1 Security = 91
Details
Alarms By Severity
Last update: 12:57:00 29 Jun
Info = 10
Minor = 2
Major = 72
Total = 201
Critical = 117
Critical = 117 Major = 72 Minor = 2 Info = 10
Details
Tasks
Alarms
Setup
Query
Manage
Acknowledge
UnAcknowledge
Delete Active
Delete Cleared
Reports
Alarm Summary
Alarm History
Config: 6 Errors; 177 Warnings Local Changes: 1 device Network Changes: 2 devices Alarms 117 72 2 10 201

There are three ways to view **Alarm Summary** details. Like the **Status Summary** table, **blue** numbers are hyperlinks. Click on a hyperlink to view the details for that item. You can also click **Details** to switch from the Alarm Summary view to the Alarm Monitor panel, or select Alarms from the navigation bar. All three selections transfer the view from the Monitor dashboard to the Alarms dashboard. In the Alarms dashboard, you can navigate to a table view for all or specific alarms. For example, clicking on the **Critical** area of the previous graph opens the **Alarms** dashboard view. *RingMaster* filters data so that only critical system alarms are shown.

To get to an alarms detail view, you can click on an alarm category.

The **Alarms Summary** window has the following features:

- A single panel displays all fault related information.
- System allows correlation (periodic or toggle) so that trap events do not always generate a new fault. This reduces the number of faults to be managed.
- Faults are be categorized by different functional areas:

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  - Client
  - Performance
  - Security
  - System
- Faults are assigned one of several severities:
  - Critical (Red)
  - Info (Blue)
  - Major (Orange)
  - Minor (Yellow)
- Source information (MX, *RingMaster*) for a fault is provided.
  - For each fault, you are provided information such as cause, fault object and event history.
  - Overall status (consolidation of operational status and fault severity) is propagated to the appropriate physical or logical entity in the Monitoring view.
  - You can sort faults based on any of the displayed columns. When faults are sorted on time/date of occurrence they are organized as **Today**, **Yesterday**.
  - Filtering based on **Category**, **Severity,** and **Type** is available.
  - Provides text search capability

In this view, there are **Tasks** panel items including the following:

- View
  - **Setup**
  - **Query**
- Manage
  - **Acknowledge**
  - **Unacknowledge**
  - **Delete Active**
  - **Delete Cleared**
- Reports
  - **Alarm Summary**
  - **Alarm History**

Fault Management

- Each fault has an associated state — active, acknowledged, cleared).
- You can perform tasks such as **Acknowledge**, **UnAcknowledge Delete Active** and **Delete Cleared** to manage faults.
- For some faults, there is a pre-determined task list to guide you on tasks/resolutions that can be performed on a fault.

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- If the *RingMaster Server* restarts after being down for a prolonged period of time, say 1 hour, all faults are cleared on restart since we can no longer guarantee if these faults are valid.
- If a fault has already been cleared or acknowledged and a new event occurs which can be correlated to this fault, this fault is made active again
- Whenever the state of a fault is changed — from active to acknowledge etc — the last update time is updated
- You can multi-select faults and perform any fault management operations.
- RFDetect and Status summary subsystems generate relevant events which are displayed as a fault.

Fault Storage and History

- Fault information is stored on the server so multiple clients can access it.
- For each fault, all correlated traps/events are stored.
- Active fault information and fault information history are maintained by the server (in the database)
- You can view historic Fault information, if required (on-demand reports).
- Fault database is periodically purged so it does not keep growing. Purging is based on criteria such as the number of active faults (events) or number of days for which data is preserved.

Fault Reporting

- Provides the capability to export fault data (.csv).
- Provides the following reports:
  - Alarm Summary report — Counts of current faults in the system by Category, Severity, Type, Active or Cleared.
  - Alarm History report — This report provides a list of faults in the system over a specified time period. Filter criteria may be Category, Severity or Type.

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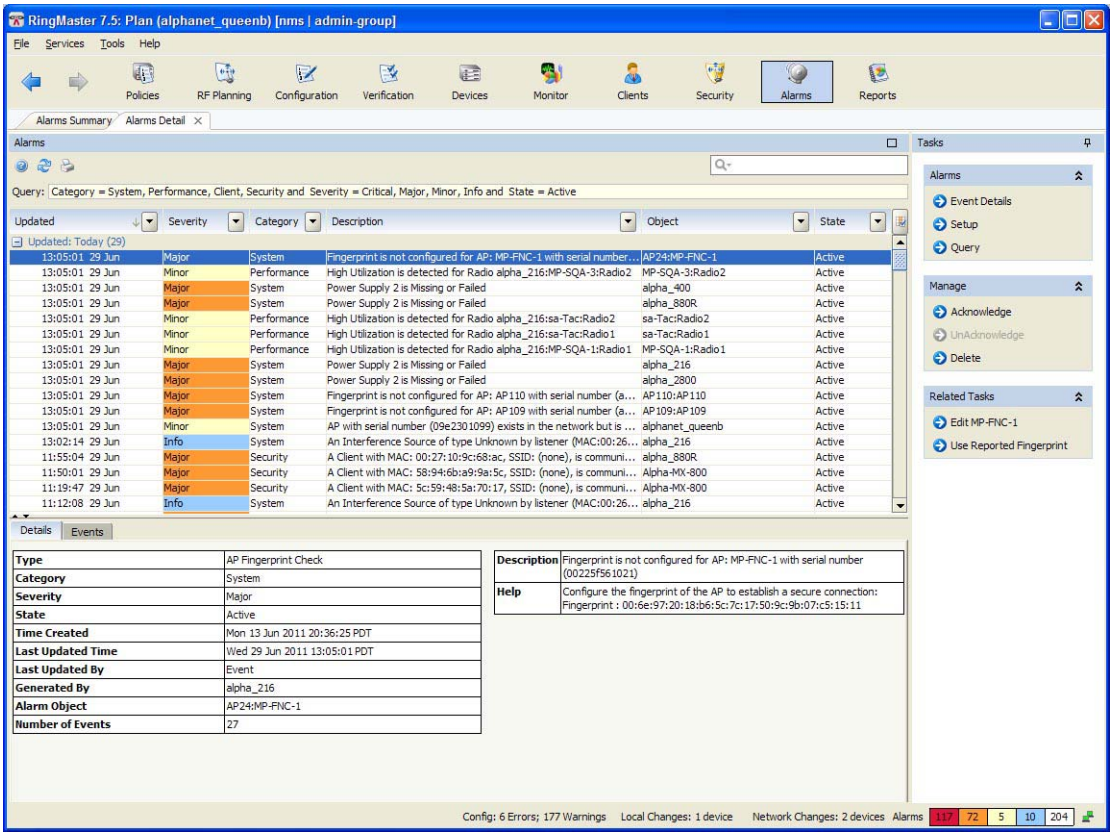
Alarms Detail Window

If you click on the **Alarms Detail** tab, you see the following window:


RingMaster 7.5: Plan (alphanet_queenb) [nms | admin-group]
File Services Tools Help
Policies RF Planning Configuration Verification Devices Monitor Clients Security Alarms Reports
Alarms Summary Alarms Detail
Alarms
Query: Category = System, Performance, Client, Security and Severity = Critical, Major, Minor, Info and State = Active
Updated Severity Category Description Object State
Updated: Today (29)
13:05:01 29 Jun Major System Fingerprint is not configured for AP: MP-FNC-1 with serial number... AP24:MP-FNC-1 Active
13:05:01 29 Jun Minor Performance High Utilization is detected for Radio alpha_216:MP-SQA-3:Radio2 MP-SQA-3:Radio2 Active
13:05:01 29 Jun Major System Power Supply 2 is Missing or Failed alpha_400 Active
13:05:01 29 Jun Major System Power Supply 2 is Missing or Failed alpha_880R Active
13:05:01 29 Jun Minor Performance High Utilization is detected for Radio alpha_216:sa-Tac:Radio2 sa-Tac:Radio2 Active
13:05:01 29 Jun Minor Performance High Utilization is detected for Radio alpha_216:sa-Tac:Radio1 sa-Tac:Radio1 Active
13:05:01 29 Jun Minor Performance High Utilization is detected for Radio alpha_216:MP-SQA-1:Radio1 MP-SQA-1:Radio1 Active
13:05:01 29 Jun Major System Power Supply 2 is Missing or Failed alpha_216 Active
13:05:01 29 Jun Major System Power Supply 2 is Missing or Failed alpha_2800 Active
13:05:01 29 Jun Major System Fingerprint is not configured for AP: AP110 with serial number (a... AP110:AP110 Active
13:05:01 29 Jun Major System Fingerprint is not configured for AP: AP109 with serial number (a... AP109:AP109 Active
13:05:01 29 Jun Minor System AP with serial number (09e2301099) exists in the network but is ... alphanet_queenb Active
13:02:14 29 Jun Info System An Interference Source of type Unknown by listener (MAC:00:26... alpha_216 Active
11:55:04 29 Jun Major Security A Client with MAC: 00:27:10:9c:68:ac, SSID: (none), is communi... alpha_880R Active
11:50:01 29 Jun Major Security A Client with MAC: 58:94:6b:a9:9a:5c, SSID: (none), is communi... Alpha-MX-800 Active
11:19:47 29 Jun Major Security A Client with MAC: 5c:59:48:5a:70:17, SSID: (none), is communi... Alpha-MX-800 Active
11:12:08 29 Jun Info System An Interference Source of type Unknown by listener (MAC:00:26... alpha_216 Active
Details Events
Type AP Fingerprint Check
Category System
Severity Major
State Active
Time Created Mon 13 Jun 2011 20:36:25 PDT
Last Updated Time Wed 29 Jun 2011 13:05:01 PDT
Last Updated By Event
Generated By alpha_216
Alarm Object AP24:MP-FNC-1
Number of Events 27
Description Fingerprint is not configured for AP: MP-FNC-1 with serial number (00225f561021)
Help Configure the fingerprint of the AP to establish a secure connection: Fingerprint : 00:6e:97:20:18:b6:5c:7c:17:50:9c:9b:07:c5:15:11
Tasks
Alarms
Event Details
Setup
Query
Manage
Acknowledge
UnAcknowledge
Delete
Related Tasks
Edit MP-FNC-1
Use Reported Fingerprint
Config: 6 Errors; 177 Warnings Local Changes: 1 device Network Changes: 2 devices Alarms 117 72 5 10 204

In this view, there are **Tasks** panel items including the following:

- Alarms
  - **Event Details**
  - **Setup**
  - **Query**
- Manage
  - **Acknowledge**
  - **Unacknowledge**
  - **Delete**
- Reports
  - **Add to Rogue List**
  - **Add to Neighbor List**

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- **Create Third-Party AP**
- **Locate**

You can select individual alarms and click **Event Details** in the **Tasks** panel to see more detail:

WMS1200-LA Alarms Displayed by RingMaster

If you choose to integrate the WMS1200-LA with RingMaster to manage your network management software the following WMS1200-LA alarms are displayed in the **Alarms** panel of RingMaster:

- **AP Snoop Status**
- **Agent Status**
- **Asset Tag Button Pressed**
- **Asset Tag Battery Low**
- **Asset Tag Detached**

Setting Up the Fault Management System

Setting up of the Fault Management system is done by users, service administrators, provisioning users, and monitoring users, including performing the following tasks:

- Customize faults — for example: assign severity to faults and set up e-mail notifications.
- Enable or disable faults based on their category or severity.
- Modify fault settings in the Fault Management System — Service administrators only.
- Manage faults and invoke resolutions, if available — Provisioning users.
- View faults and acknowledge or disregard the faults — Monitoring users.

To set up the Fault Management System:

1. Select the **Alarms** button on the main *RingMaster* Navigation Bar.
2. Click **Setup** in the **Task Panel**. The **Alarm Setup** dialog is displayed.
3. Select the type of alarms to enable by selecting the appropriate check box. Notice that there are several types available for various severity levels.
4. Click the **Notification** tab, click on **Create** and set an alarm **Profile Name**, enable it by clicking the **Enable Alarm Notification** checkbox, enter an e-mail address where you wish to receive alerts, and use check boxes to indicate the severity levels for which *RingMaster* sends an e-mail notification.

You can select severity levels for the following categories:

- **Critical**
- **Major**
- **Minor**
- **Informational**

5. Click the **Database Maintenance** tab. The **Database Maintenance** tab allows you to specify how many faults to store in a database how many days to keep uncleared faults. In addition, this tab is used to specify the number of days to keep active Critical, Major, Minor, and Informational alarms in the database.

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Enter the desired values in the following fields as follows:

- **Number of events per alarm** — The number of recent events that should be retained in the database for each alarm.
- **Number of days** — The number of days after which any cleared alarms are deleted from the database.

Age Time section:

- **Critical** — The number of days after which any active Critical alarms will be aged.
- **Major** — The number of days after which any active Major alarms will be aged.
- **Minor** — The number of days after which any active Minor alarms will be aged.
- **Informational** — The number of days after which any active Informational alarms will be aged.

6. Click **Save** to save your changes, then **Close** to close the dialog.

Alarms Database Query

RingMaster can filter alarms based on any of the columns in the table. *RingMaster* sorts faults based on a **Scope, Date/Time, Categories, Severities, States** and/or **Description Text** you indicate by selecting an alarm and clicking **Query** in the **Tasks** panel.

Storing Faults and Retrieving Fault History

RingMaster stores fault information in a server database and allows multiple clients to access this data. With each fault stored in the database, correlated traps and events are stored. Data is periodically purged to keep the database a manageable size. Purging is based on criteria such as the number of active faults (events) or the number of days for which data should be preserved.

In addition to active fault information, this database holds historic fault information. You can view this information when necessary. However, it is available for viewing in reports only. You cannot perform any action on historic information.

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Detecting Rogue Devices

AP radios automatically scan the RF spectrum for other devices transmitting in the same spectrum. RF scans discover third-party transmitters in addition to other Trapeze radios. MSS considers non-Trapeze transmitters to be *devices of interest*, which are potential rogues. You can display information about potential rogues. To identify friendly devices, such as non-Trapeze access points in your or a neighbor's network, you can add them to the known devices list. You can enable countermeasures to prevent clients from using devices that are true rogues. With *RingMaster*, you also can display the physical location of a rogue device.

Rogue Detection Requirements

Rogue detection in *RingMaster* has the following requirements:

- The **Enable Rogue Detection** option must be selected on the **Monitoring Settings** section of the *RingMaster Services* **Setup** page. (Refer to **Monitoring Settings**.)
- To use countermeasures, they must be enabled. You can enable them on an individual radio profile basis. (See "Viewing and Configuring Radio Profiles" in the publication *RingMaster Configuration Guide*.)
- SNMP notifications must be enabled on the MXs. **Table 1– 1** lists the notification types related to RF detection. The notification types for Intrusion Detection System (IDS) and Denial of Service (DoS) protection are also listed. (To enable notifications on a switch, see "Configuring SNMP" in the publication *RingMaster Configuration Guide*.)

Notification Type	Description
RogueDetect	MSS has detected a rogue AP.
RFDetectRogueDisappear	MSS is no longer detecting a previously detected rogue AP.
RFDetectInterferingRogueAP	MSS has detected an interfering device.
RFDetectInterferingRogueDisappear	MSS is no longer detecting a previously detected interfering device.
RFDetectAdHocUser	MSS has detected an ad-hoc user.
RFDetectUnAuthorizedSSID	MSS has detected an SSID that is not on the permitted SSID list. (See **Rogue Detection Lists**.)
RFDetectUnAuthorizedOUI	MSS has detected a wireless device that is not on the list of permitted vendors. (See **Rogue Detection Lists**.)
RFDetectUnAuthorizedAP	MSS has detected the MAC address of an AP that is on the attack list. (See **Rogue Detection Lists**.)

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Notification Type	Description
IDS/DoS notifications	For more information about IDS/DoS, see the “IDS and DoS Alerts” section in the “Rogue Detection and Countermeasures” chapter of the Trapeze Mobility System Software Configuration Guide.
CounterMeasureStart	MSS has begun countermeasures against a rogue AP.
CounterMeasureStop	MSS has stopped countermeasures against a rogue access point.
RFDetectSpoofedMacAP	MSS has detected a wireless packet with the source MAC address of a Trapeze AP, but without the AP’s spoofed signature (fingerprint).
RFDetectSpoofedSSIDAP	MSS has detected beacon frames for a valid SSID, but sent by a rogue AP.
RFDetectDoS	MSS has detected a DoS attack other than an associate request flood, reassociate request flood, or disassociate request flood.
RFDetectDoSPort	MSS has detected an associate request flood, reassociate request flood, or disassociate request flood.
RFDetectClientViaRogueWiredAP	MSS has detected, on the wired part of the network, the MAC address of a wireless client associated with a third-party AP.

Mobility Domain Requirement

RF Detection requires a Mobility Domain to be available. If no Mobility Domain is operational — not all members are up — no new RF Detection data is processed. Existing RF Detection information ages normally. Processing of RF Detection data is resumed when all members of a Mobility Domain are up. If a seed MX in a Mobility Domain cannot resume full operation, you can restore the Mobility Domain to full operation, and therefore resume RF Detection data processing, by removing inoperative MXs from the member list on the seed.

Rogue Detection Lists

Rogue detection lists specify third-party devices and SSIDs that MSS allows on a network, and devices MSS classifies as rogues.

You can configure the following rogue detection lists:

- **Permitted SSID list** — A list of SSIDs allowed in the Mobility Domain. MSS generates a message if an SSID not on the list is detected.
- **Permitted vendor list** — A list of the wireless networking equipment vendors whose equipment is allowed on the network. *RingMaster* identifies the vendor using the Organizationally Unique Identifier (OUI) The OUI is the first three bytes of the MAC address of the equipment. MSS generates a message if an AP or wireless client with an OUI that is not on the list is detected.
- **Rogue list** — A list of AP MAC addresses to attack whenever they are present on the network.
- **Client black list** — A list of MAC addresses of wireless clients who are not allowed on the network. MSS prevents clients on the list from accessing the network through an MX. If the client is placed on the black list dynamically by MSS due to an association, reassociation or disassociation flood, MSS generates a log message.
- **Ignore list** — A list of third-party devices that you want to exempt from rogue detection. MSS does not count devices on the ignore list as rogues or interfering devices, and does not issue countermeasures against them.

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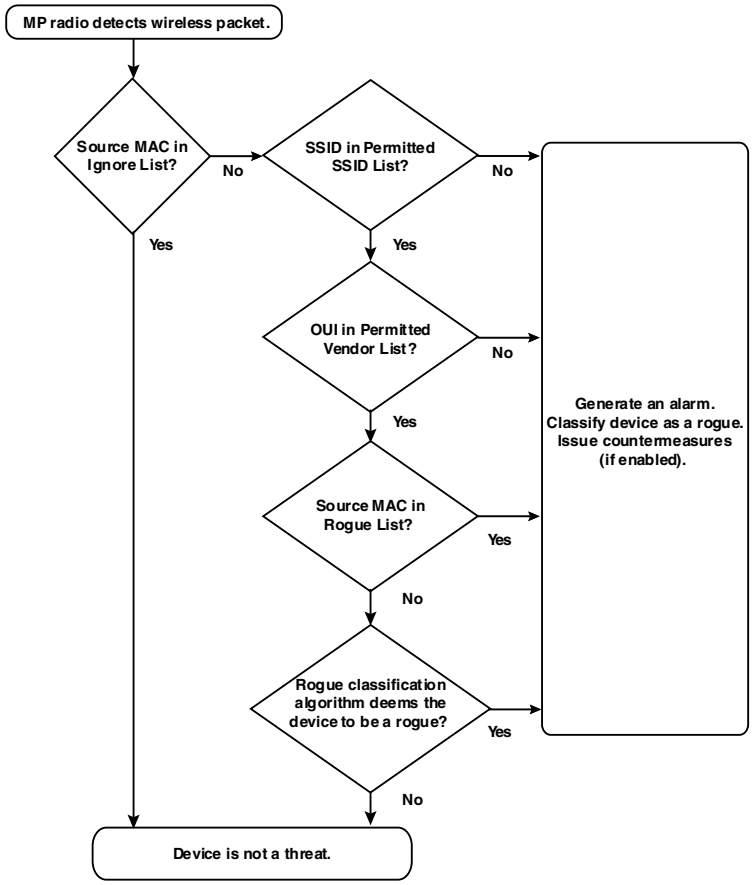
An empty permitted SSID list or permitted vendor list implicitly allows all SSIDs and vendors. When you add an entry to the SSID or vendor list, SSIDs or vendors not in the list are disallowed. An empty client black list allows all clients, and an empty ignore list considers all third-party wireless devices to be potential rogues. All lists except the black list require manual configuration. You can configure entries in the black list, and MSS can place a client in the black list, due to an association, reassociation, or disassociation flood from a client.

The rogue classification algorithm examines each of these lists when determining if a device is a rogue. **Figure 1–1** shows how the rogue detection algorithm uses lists.

Figure 1–1. Rogue Detection Algorithm



Using Fault Management to Locate a Rogue

This section provides an example of how you can use the Fault Management system to locate rogue devices on your network, then configure MSS to use countermeasures against them. AP radios automatically scan the RF spectrum for other devices transmitting in the same spectrum. The RF scans discover third-party transmitters in addition to other Trapeze radios. MSS considers the non-Trapeze transmitters to be devices of interest, which are potential rogues.

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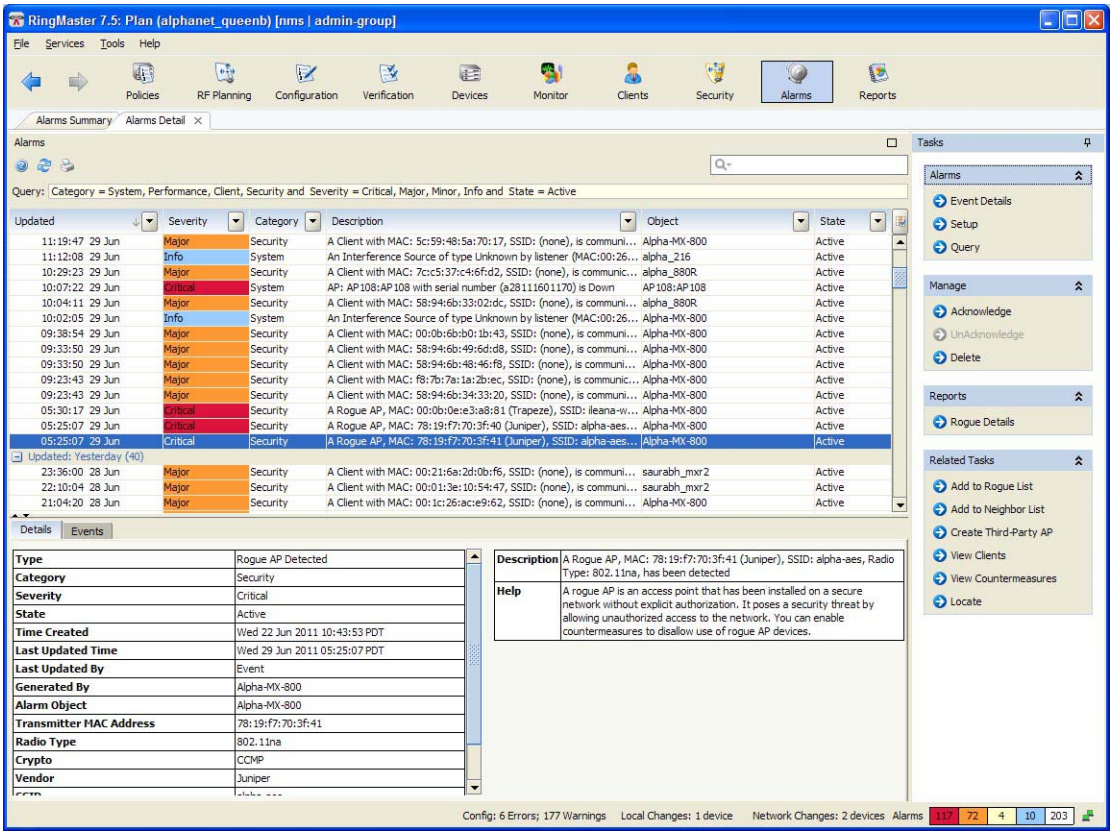
A rogue access point is an unauthorized access point on your network. Rogue access points and their clients undermine the security of an enterprise network by potentially allowing unchallenged access to the network by any wireless user or client in the physical vicinity. Rogue access points and users can also interfere with the operation of your enterprise network. You can configure *RingMaster* to automatically use countermeasures against rogue APs to disable them.

Not all access points placed on the rogue list are “hostile” rogues. You may want to move some of the access points from the rogue list to a known devices list or a third-party AP list.

Locating a rogue

1. Click on the **Alarms** button on the main *RingMaster* Navigation Bar. An **Alarms Summary** is displayed.
2. Click on **Query** and select options including “rogue” in the description field.
3. Select **OK** anda list of rogues is displayed, or a rapid indication of none being found.
4. You can also click on one of the alarms in the **Alarms Detail** list to display details about it.


RingMaster 7.5: Plan (alphanet_queenb) [nms | admin-group]
File Services Tools Help
Policies RF Planning Configuration Verification Devices Monitor Clients Security Alarms Reports
Alarms Summary Alarms Detail
Alarms
Query: Category = System, Performance, Client, Security and Severity = Critical, Major, Minor, Info and State = Active
Updated Severity Category Description Object State
Tasks
Alarms
Event Details
Setup
Query
Manage
Acknowledge
UnAcknowledge
Delete
Reports
Rogue Details
Related Tasks
Add to Rogue List
Add to Neighbor List
Create Third-Party AP
View Clients
View Countermeasures
Locate
Details Events
Type Rogue AP Detected
Category Security
Severity Critical
State Active
Time Created Wed 22 Jun 2011 10:43:53 PDT
Last Updated Time Wed 29 Jun 2011 05:25:07 PDT
Last Updated By Event
Generated By Alpha-MX-800
Alarm Object Alpha-MX-800
Transmitter MAC Address 78:19:f7:70:3f:41
Radio Type 802.11na
Crypto CCMP
Vendor Juniper
Description A Rogue AP, MAC: 78:19:f7:70:3f:41 (Juniper), SSID: alpha-aes, Radio Type: 802.11na, has been detected
Help A rogue AP is an access point that has been installed on a secure network without explicit authorization. It poses a security threat by allowing unauthorized access to the network. You can enable countermeasures to disallow use of rogue AP devices.
Config: 6 Errors; 177 Warnings
Local Changes: 1 device
Network Changes: 2 devices
Alarms 117 72 4 10 203

5. Click the **Event Details** tab to display events *RingMaster* has recorded about the rogue. The number of listeners (other APs) that detected the rogue are displayed. The larger the number of listeners detecting the rogue, the easier it is for *RingMaster* to locate the rogue in the RF coverage area.

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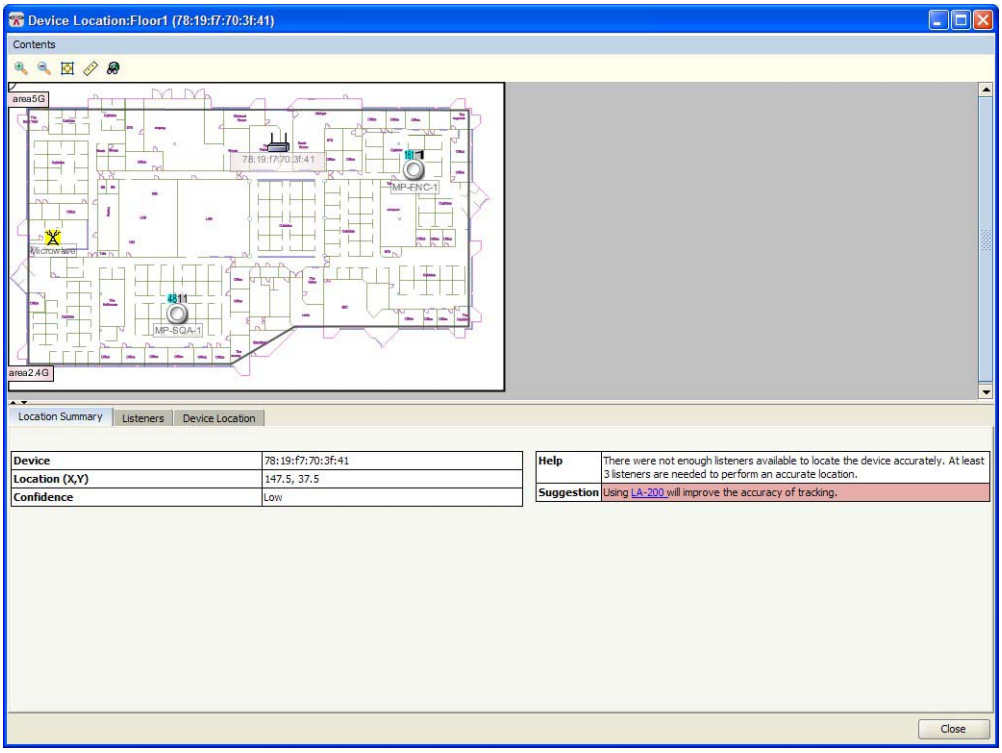
6. You can locate the rogue in the RF coverage area. In the **Tasks** panel, under **Related Tasks**, click **Locate**.
7. You will see a Select Listeners dialog that allows you to select which listeners to use in this location effort. Make selections, then click **OK**.
8. You will see a Progress dialog.

The approximate location of a rogue is displayed in the RF coverage area.

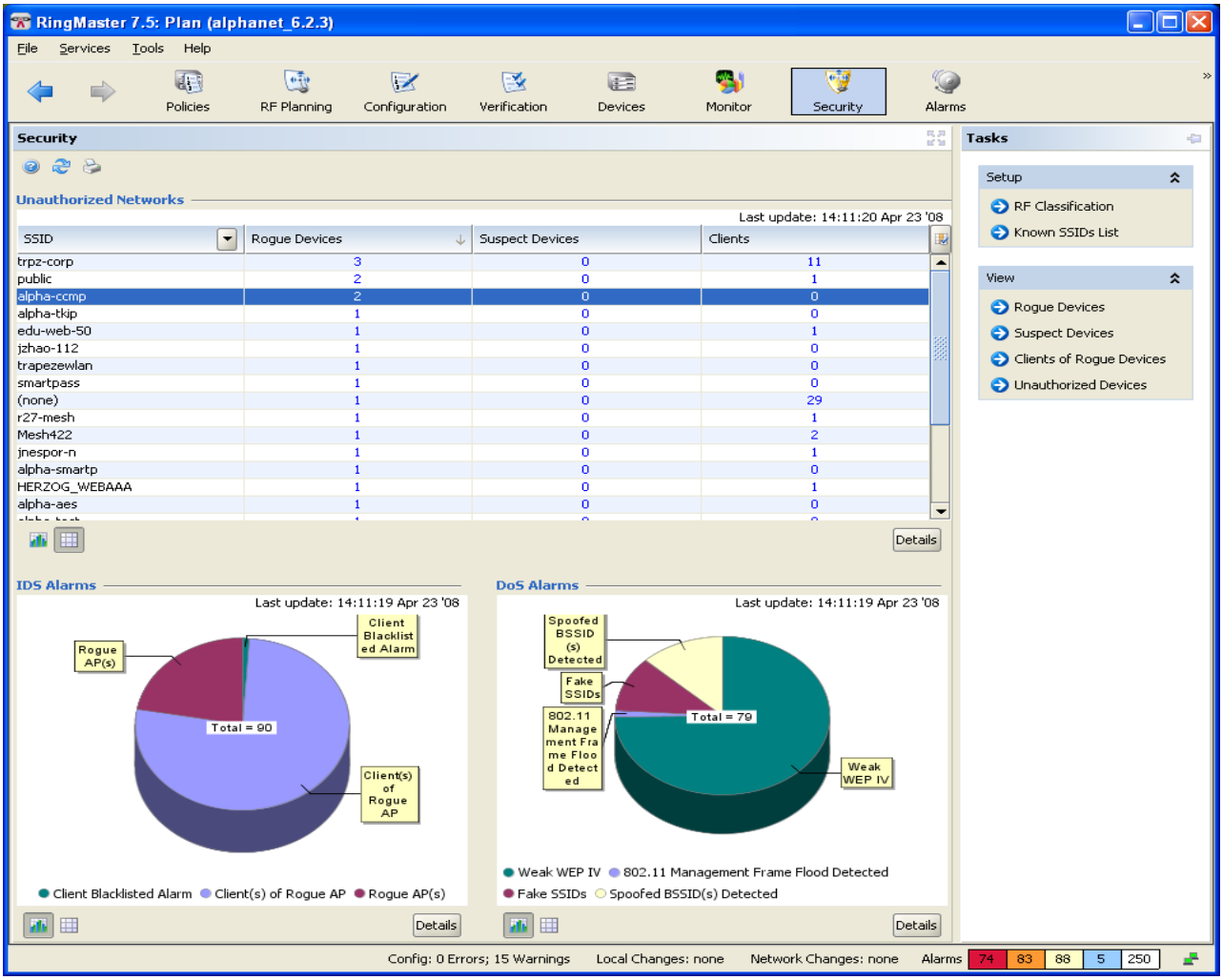


9. To change the APs used for calculating the location of the rogue, click the **Listeners** tab and select or deselect APs from the list, then click the (Locate) button.

To enable countermeasures agains rogues, refer to “Configuring Countermeasures” in the publication *RingMaster Configuration Guide*.

Managing Security

The **Security** feature on the main window that allows you to both **Setup** and **View** items related to **Unauthorized Networks**, **IDS Alarms** and **DoS Alarms**. Wen you click the **Security** button on the main *RingMaster* window, you see the following security information in the **Content** panel.



In this view, there are **Tasks** panel items including the following:

- Setup
  - **RF Classification**
  - **Known SSIDs List**
- View
  - **Rogue Devices**
  - **Suspect Devices**
  - **Clients of Rogue Devices**
  - **Unauthorized Devices**

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Each of these is discussed in detail in the next few sections of this guide.

RF Classification

If you click **RF Classification**, you can create policies and control devices on the network.

1. You can select checkboxes to create policies and control devices n which rules are to be applied.
2. If you select **Create a new policy**, then click **Next.**
3. Enter a **Policy Name**, **MX Model Filter** and **MX Version Filter**, then click **Next**.
4. **Classification Rules** as listed in the dialog, then click **Finish**.

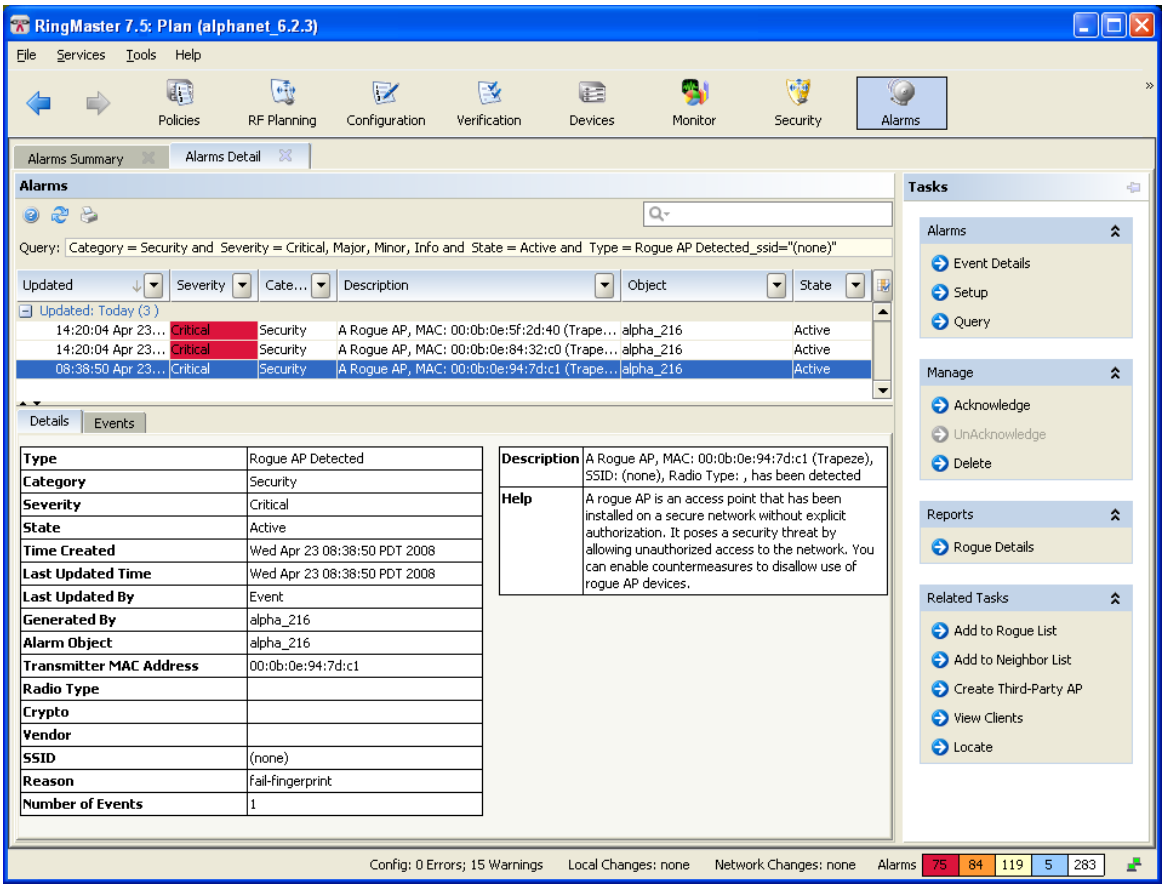
Known SSIDs List

If you click **Known SSIDs List**, you add SSIDs to the list:

1. Make selections to create policies and determine device and policy associations. If you click **Create a new policy**, you see and complete dialogs like those in step 2 and step 3 above, then you see the following dialog:
2. Move **Rogue and Suspect SSIDs** to **Known SSIDs** as appropriate, then click **Finish**.

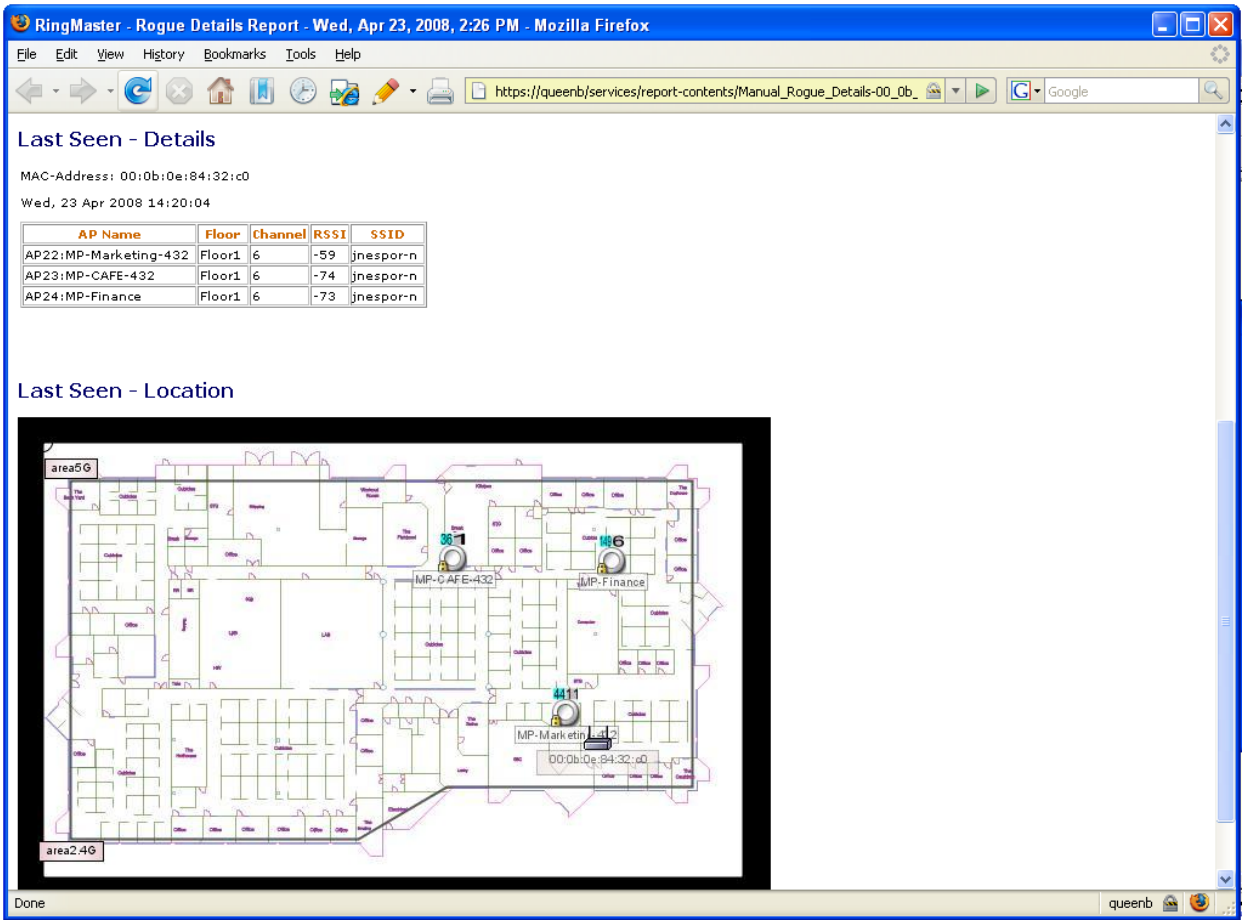
Rogue Devices

If you click **Rogue Devices**, RingMaster displays information about Rogue Devices on your network.


RingMaster 7.5: Plan (alphanet_6.2.3)
File Services Tools Help
Policies RF Planning Configuration Verification Devices Monitor Security Alarms
Alarms Summary Alarms Detail
Alarms
Query: Category = Security and Severity = Critical, Major, Minor, Info and State = Active and Type = Rogue AP Detected_ssid="(none)"
Updated Severity Cate... Description Object State
Updated: Today (3)
14:20:04 Apr 23... Critical Security A Rogue AP, MAC: 00:0b:0e:5f:2d:40 (Trape... alpha_216 Active
14:20:04 Apr 23... Critical Security A Rogue AP, MAC: 00:0b:0e:84:32:c0 (Trape... alpha_216 Active
08:38:50 Apr 23... Critical Security A Rogue AP, MAC: 00:0b:0e:94:7d:c1 (Trape... alpha_216 Active
Details Events
Type Rogue AP Detected
Category Security
Severity Critical
State Active
Time Created Wed Apr 23 08:38:50 PDT 2008
Last Updated Time Wed Apr 23 08:38:50 PDT 2008
Last Updated By Event
Generated By alpha_216
Alarm Object alpha_216
Transmitter MAC Address 00:0b:0e:94:7d:c1
Radio Type
Crypto
Vendor
SSID (none)
Reason fail-fingerprint
Number of Events 1
Description A Rogue AP, MAC: 00:0b:0e:94:7d:c1 (Trapeze), SSID: (none), Radio Type: , has been detected
Help A rogue AP is an access point that has been installed on a secure network without explicit authorization. It poses a security threat by allowing unauthorized access to the network. You can enable countermeasures to disallow use of rogue AP devices.
Tasks
Alarms
Event Details
Setup
Query
Manage
Acknowledge
UnAcknowledge
Delete
Reports
Rogue Details
Related Tasks
Add to Rogue List
Add to Neighbor List
Create Third-Party AP
View Clients
Locate
Config: 0 Errors; 15 Warnings
Local Changes: none
Network Changes: none
Alarms 75 84 119 5 283

Suspect Devices

If you click **Rogue Devices**, you can specify a rogue by MAC-address and click on **Next**. **Generate Report** is displayed with a link the report.


RingMaster - Rogue Details Report - Wed, Apr 23, 2008, 2:26 PM - Mozilla Firefox
File Edit View History Bookmarks Tools Help
https://queenb/services/report-contents/Manual_Rogue_Details-00_0b_
Google
Last Seen - Details
MAC-Address: 00:0b:0e:84:32:c0
Wed, 23 Apr 2008 14:20:04
AP Name | Floor | Channel | RSSI | SSID
AP22:MP-Marketing-432 | Floor1 | 6 | -59 | jnespor-n
AP23:MP-CAFE-432 | Floor1 | 6 | -74 | jnespor-n
AP24:MP-Finance | Floor1 | 6 | -73 | jnespor-n
Last Seen - Location
area5G
MP-CAFE-432
MP-Finance
area2.4G
Done
queenb

3. Click **Finish**.

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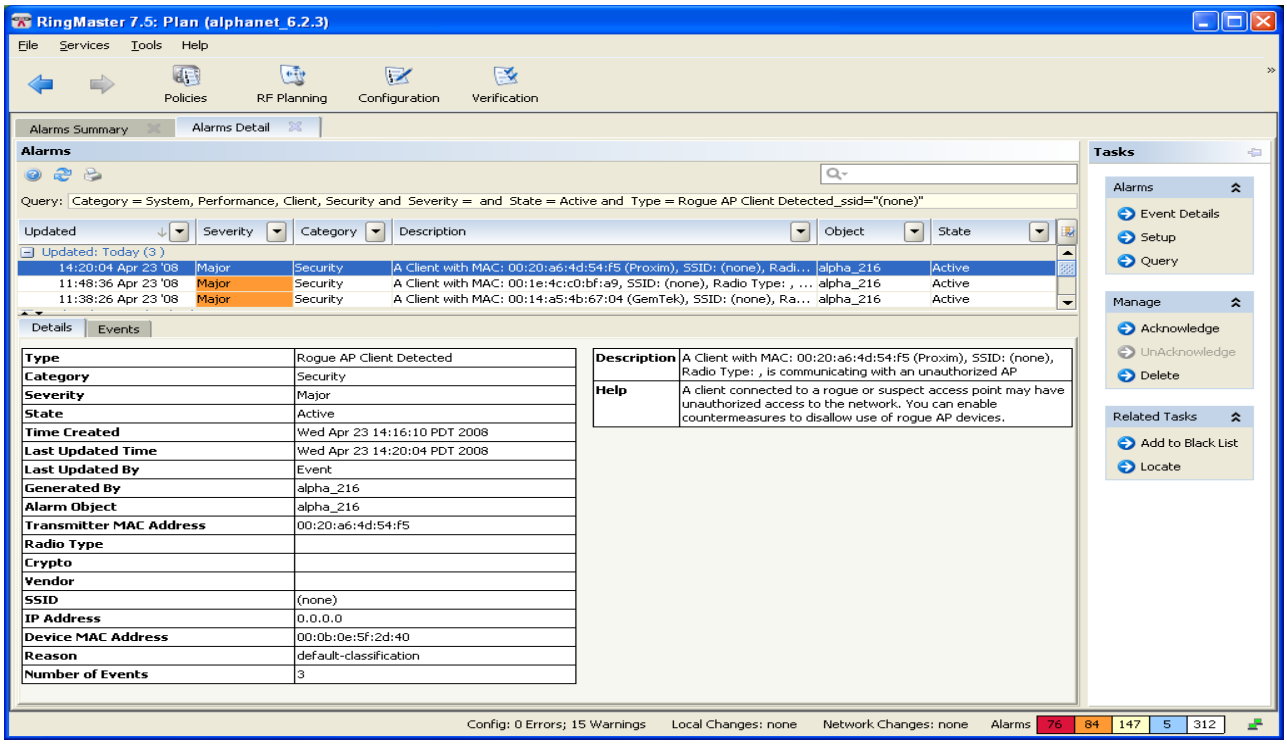
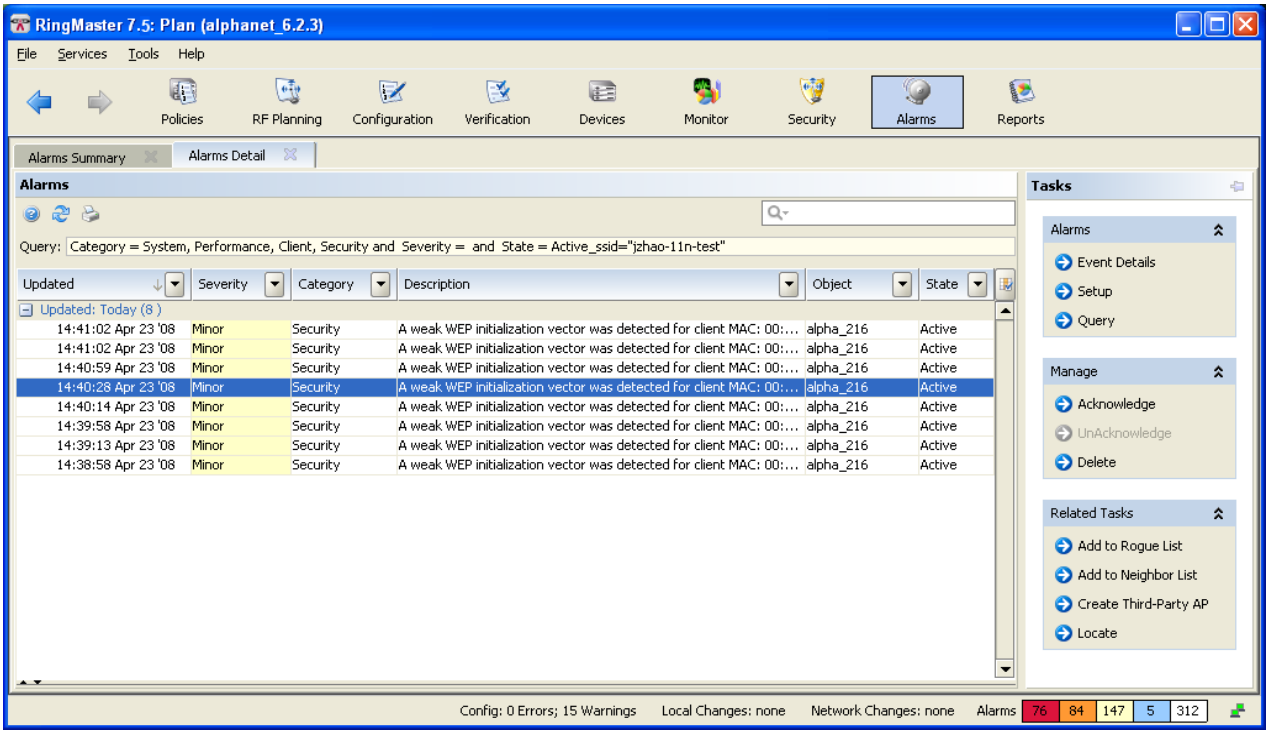
Clients of Rogue Devices

If you click **Clients of Rogue Devices**, you see the following window:


RingMaster 7.5: Plan (alphanet_6.2.3)
File Services Tools Help
Policies RF Planning Configuration Verification
Alarms Summary Alarms Detail
Alarms
Query: Category = System, Performance, Client, Security and Severity = and State = Active and Type = Rogue AP Client Detected_ssid="(none)"
Updated Severity Category Description Object State
Updated: Today (3)
14:20:04 Apr 23 '08 Major Security A Client with MAC: 00:20:a6:4d:54:f5 (Proxim), SSID: (none), Radi... alpha_216 Active
11:48:36 Apr 23 '08 Major Security A Client with MAC: 00:1e:4c:c0:bf:a9, SSID: (none), Radio Type: , ... alpha_216 Active
11:38:26 Apr 23 '08 Major Security A Client with MAC: 00:14:a5:4b:67:04 (GemTek), SSID: (none), Ra... alpha_216 Active
Details Events
Type Rogue AP Client Detected
Category Security
Severity Major
State Active
Time Created Wed Apr 23 14:16:10 PDT 2008
Last Updated Time Wed Apr 23 14:20:04 PDT 2008
Last Updated By Event
Generated By alpha_216
Alarm Object alpha_216
Transmitter MAC Address 00:20:a6:4d:54:f5
Radio Type
Crypto
Vendor
SSID (none)
IP Address 0.0.0.0
Device MAC Address 00:0b:0e:5f:2d:40
Reason default-classification
Number of Events 3
Description A Client with MAC: 00:20:a6:4d:54:f5 (Proxim), SSID: (none), Radio Type: , is communicating with an unauthorized AP
Help A client connected to a rogue or suspect access point may have unauthorized access to the network. You can enable countermeasures to disallow use of rogue AP devices.
Tasks
Alarms
Event Details
Setup
Query
Manage
Acknowledge
UnAcknowledge
Delete
Related Tasks
Add to Black List
Locate
Config: 0 Errors; 15 Warnings
Local Changes: none
Network Changes: none
Alarms 76 84 147 5 312

Unauthorized Devices

If you click **Unauthorized Devices**, RingMaster displays information about any unauthorized wireless devices on the network.


RingMaster 7.5: Plan (alphanet_6.2.3)
File
Services
Tools
Help
Policies
RF Planning
Configuration
Verification
Devices
Monitor
Security
Alarms
Reports
Alarms Summary
Alarms Detail
Alarms
Query: Category = System, Performance, Client, Security and Severity = and State = Active_ssid="jzhao-11n-test"
Updated
Severity
Category
Description
Object
State
Updated: Today (8)
14:41:02 Apr 23 '08 Minor Security A weak WEP initialization vector was detected for client MAC: 00:... alpha_216 Active
14:41:02 Apr 23 '08 Minor Security A weak WEP initialization vector was detected for client MAC: 00:... alpha_216 Active
14:40:59 Apr 23 '08 Minor Security A weak WEP initialization vector was detected for client MAC: 00:... alpha_216 Active
14:40:28 Apr 23 '08 Minor Security A weak WEP initialization vector was detected for client MAC: 00:... alpha_216 Active
14:40:14 Apr 23 '08 Minor Security A weak WEP initialization vector was detected for client MAC: 00:... alpha_216 Active
14:39:58 Apr 23 '08 Minor Security A weak WEP initialization vector was detected for client MAC: 00:... alpha_216 Active
14:39:13 Apr 23 '08 Minor Security A weak WEP initialization vector was detected for client MAC: 00:... alpha_216 Active
14:38:58 Apr 23 '08 Minor Security A weak WEP initialization vector was detected for client MAC: 00:... alpha_216 Active
Tasks
Alarms
Event Details
Setup
Query
Manage
Acknowledge
UnAcknowledge
Delete
Related Tasks
Add to Rogue List
Add to Neighbor List
Create Third-Party AP
Locate
Config: 0 Errors; 15 Warnings
Local Changes: none
Network Changes: none
Alarms
76
84
147
5
312

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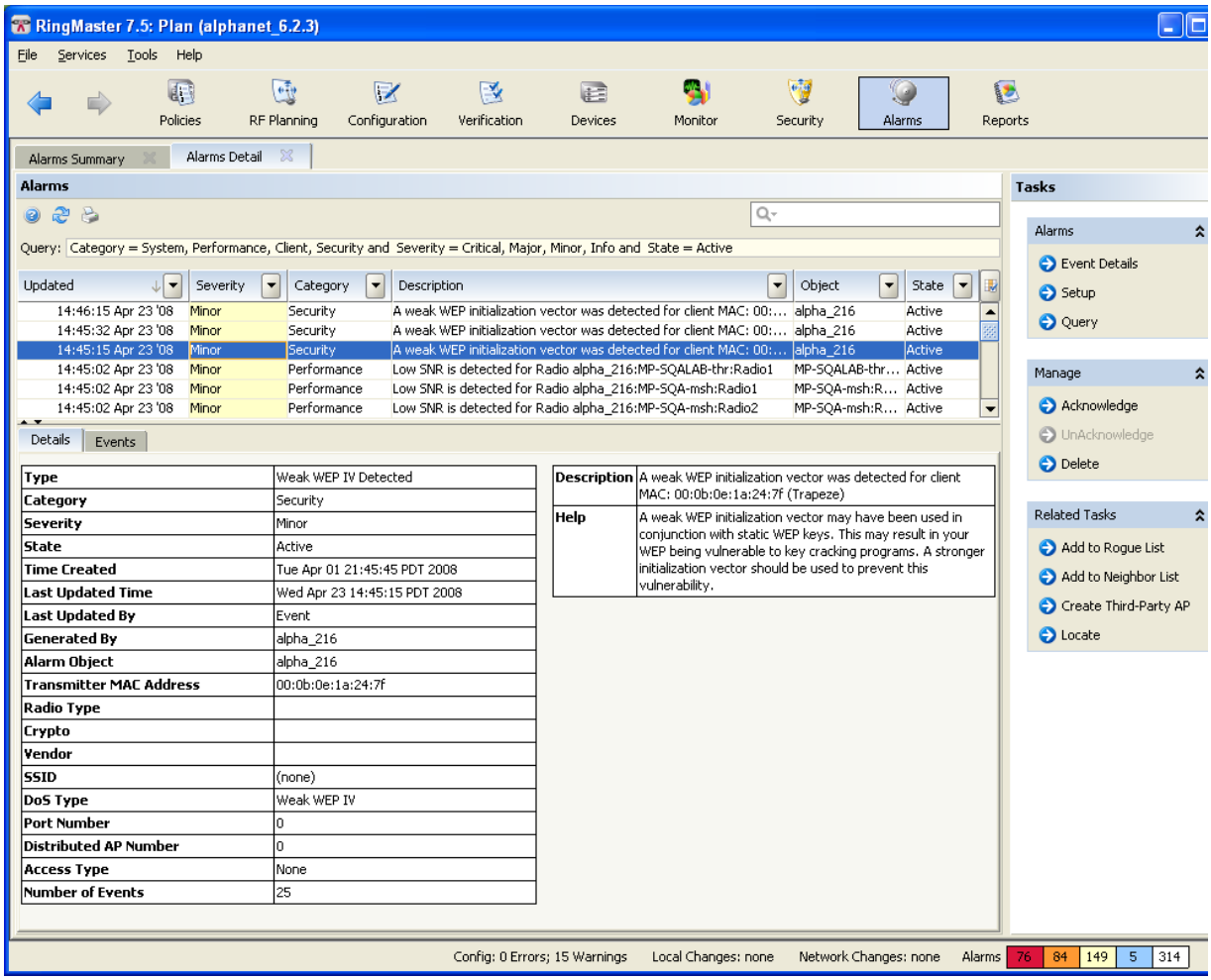
Displaying Rogue Information

To display rogue information, select the **Monitor** button on the main *RingMaster* Navigation Bar and click on **Details** in the **Alarm Summary** area to see the **Alarms Detail** window below.


RingMaster 7.5: Plan (alphanet_6.2.3)
File Services Tools Help
Policies RF Planning Configuration Verification Devices Monitor Security Alarms Reports
Alarms Summary Alarms Detail
Alarms
Query: Category = System, Performance, Client, Security and Severity = Critical, Major, Minor, Info and State = Active
Updated Severity Category Description Object State
14:46:15 Apr 23 '08 Minor Security A weak WEP initialization vector was detected for client MAC: 00:... alpha_216 Active
14:45:32 Apr 23 '08 Minor Security A weak WEP initialization vector was detected for client MAC: 00:... alpha_216 Active
14:45:15 Apr 23 '08 Minor Security A weak WEP initialization vector was detected for client MAC: 00:... alpha_216 Active
14:45:02 Apr 23 '08 Minor Performance Low SNR is detected for Radio alpha_216:MP-SQALAB-thr:Radio1 MP-SQALAB-thr... Active
14:45:02 Apr 23 '08 Minor Performance Low SNR is detected for Radio alpha_216:MP-SQA-msh:Radio1 MP-SQA-msh:R... Active
14:45:02 Apr 23 '08 Minor Performance Low SNR is detected for Radio alpha_216:MP-SQA-msh:Radio2 MP-SQA-msh:R... Active
Details Events
Type Weak WEP IV Detected
Category Security
Severity Minor
State Active
Time Created Tue Apr 01 21:45:45 PDT 2008
Last Updated Time Wed Apr 23 14:45:15 PDT 2008
Last Updated By Event
Generated By alpha_216
Alarm Object alpha_216
Transmitter MAC Address 00:0b:0e:1a:24:7f
Radio Type
Crypto
Vendor
SSID (none)
DoS Type Weak WEP IV
Port Number 0
Distributed AP Number 0
Access Type None
Number of Events 25
Description A weak WEP initialization vector was detected for client MAC: 00:0b:0e:1a:24:7f (Trapeze)
Help A weak WEP initialization vector may have been used in conjunction with static WEP keys. This may result in your WEP being vulnerable to key cracking programs. A stronger initialization vector should be used to prevent this vulnerability.
Tasks
Alarms
Event Details
Setup
Query
Manage
Acknowledge
UnAcknowledge
Delete
Related Tasks
Add to Rogue List
Add to Neighbor List
Create Third-Party AP
Locate
Config: 0 Errors; 15 Warnings
Local Changes: none
Network Changes: none
Alarms 76 84 149 5 314

Each rogue is listed only once, even if multiple entries for it appear in the **Alarms** log. If a rogue is detected during three polling intervals, separate entries for each interval appear in the **Alarms** log. You can adjust selection criteria on the fault dashboard to filter an alarm list to display the following types of entries:

- **Rogue APs** — Unauthorized APs on the Trapeze network.
- **Interfering APs** — Devices that are not part of the Trapeze network but also are not rogues. No clients connected to these devices have been detected communicating with any network entity listed in the forwarding database (FDB) of any MX in a Mobility Domain. Although interfering devices are not connected to your network, they might be causing RF interference with AP radios.
- **Suspect APs** — Devices that are not part of the Trapeze network and are suspected as rogues

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- **Ad-hoc clients** — Clients configured to communicate wirelessly outside of the network infrastructure. Ad-hoc clients are not necessarily malicious, but they steal bandwidth from your infrastructure users. Ad-hoc clients are further categorized into rogues and interfering devices. The word **Rogue** or **Interfering** appears in parentheses next to the word **Ad-hoc**.

Displaying Rogue Details

To display information about a rogue, select the rogue. Additional information appears in the lower section of the screen as shown above.

Table 1– 2 describes the fields that appear on the Alarm Details for a rogue.

Field	Description
Type	The alarm type; for example, Rogue AP Detected.
Category	The category of alarm; alarms generated by rogue fall into the Security category.
State	The status of the alarm.
Time Created	The time the alarm was created.
Last Updated Time	The time the alarm was last updated by RingMaster
Last Updated By	Where in RingMaster the alarm was updated.
Generated By	The device that generated the alarm
Alarm Object	The device where the rogue alarm was detected.
Transmitter MAC address	The MAC address used by the rogue to transmit data
Radio Type	Radio technology.
Crypto	Encryption used.
Vendor	Manufacurer of device.
SSID	SSID of the rogue.
DoS Type	Type of vulnerability.
Port Number	Port number involved.
Distributed AP Number	Assigned number for this AP.
Access Type	Access to this device.
Number of Events	Count of events associated with this rogue.
Description	Description of items detected.
Help	Information of risks associated with this rogue.

Table 1– 3 describes the fields that appear on the **Events** tab for a rogue.

Column	Description
Time Occurred	When the event related to the rogue alarm occurred.
Description	Description of the event related to the rogue alarm.
Event State	Whether the rogue was detected in the network at the time the event was recorded.
No. of Listeners	Number of AP radios that detected the rogue or noted its absence.
SSID	SSID of the rogue.

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To display additional details , select the rogue in the alarm list, then click **Event Details** in the **Tasks** panel.

Displaying Rogue Client Information

To display details about the clients of rogue devices, select the rogue in the alarm list, then click **View Clients** in the **Tasks** panel. You see a dialog like the example here:

Table 1– 4 lists the information displayed on about clients of rogue devices.

Column	Description
Client	MAC address of the client.
Vendor	Manufacturer of the client.
Channel	Channel the client is on.
SSID	SSID the client is associated with.

Displaying Rogue History

To display the alarms generated during the most-recent 30-day period, click **Alarm History** in the **Tasks** panel. You see the **Alarm History Report** dialog, where you select a **Report Scope Type**, **Report Scope Instance**, **Start Time** and **End Time** and click **Next** to generate a report.

Generate Report is displayed with a link provided to the report.

Click **Finish**.

Displaying the Location of a Rogue

If building and floor information for the site is modeled in the network plan, you can display the likely physical location of a rogue, as well as clients associated with the rogue. RingMaster displays the floor plan for the floor where the rogue is believed to be located, and displays the areas where the rogue is probably located.

This option displays the likely location of the rogue when the data was collected by the monitoring service from the seed switch and a Mobility Domain. If the rogue has moved since then, the location information is out of date.

To display the location of a rogue within a site:

1. Select a rogue in the alarm list.

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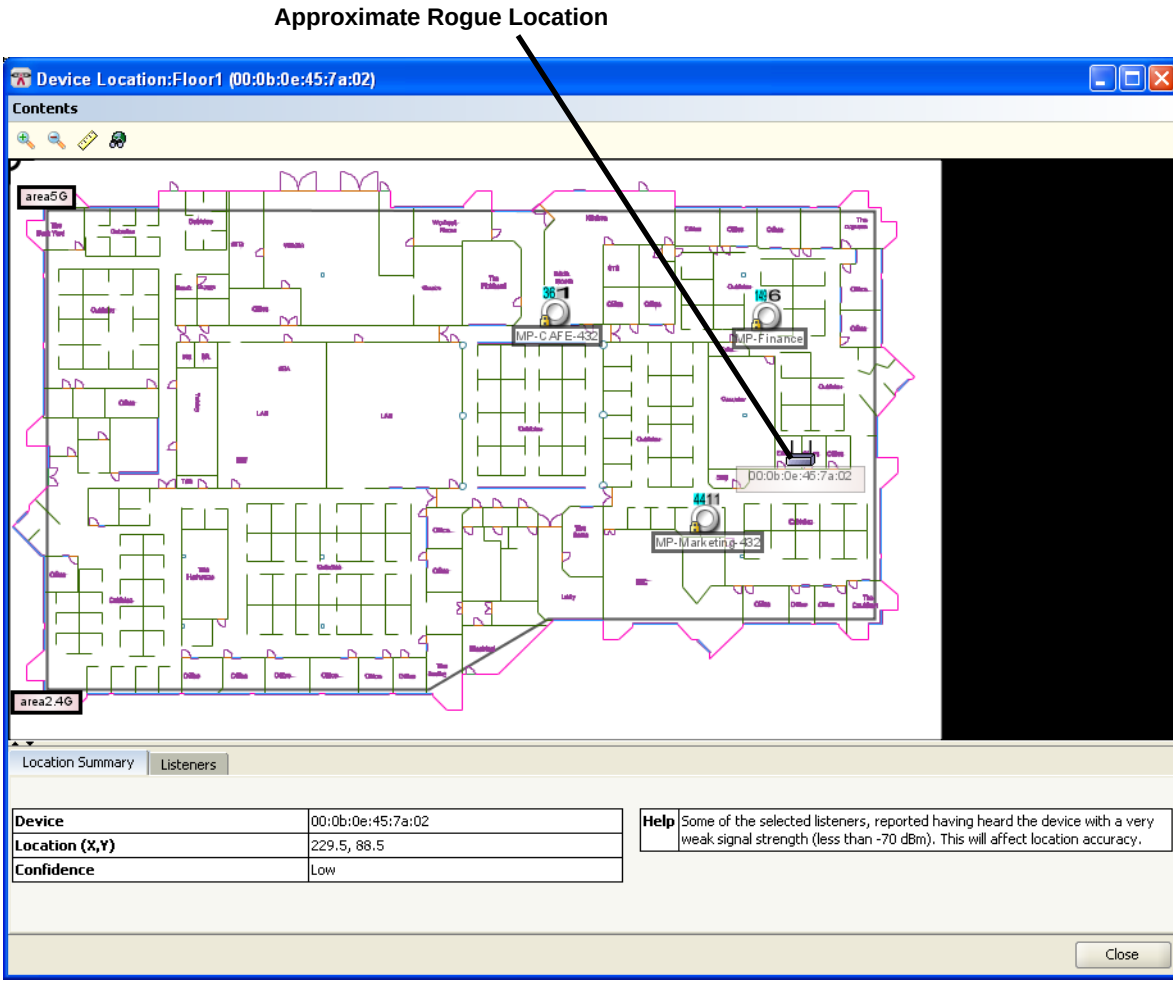
2. In the **Tasks** panel, under **Related Tasks**, click **Locate**. The **Device Location** screen appears, indicating the approximate location of the rogue



3. To change the APs used for calculating the location of a rogue, click the **Listeners** tab and select or deselect APs from the list, then click Locate.

To display the location of a client associated with a rogue:

1. Select the rogue client in the **Alarm** list.
2. In the **Tasks** panel, under **Related Tasks**, click **Locate**.

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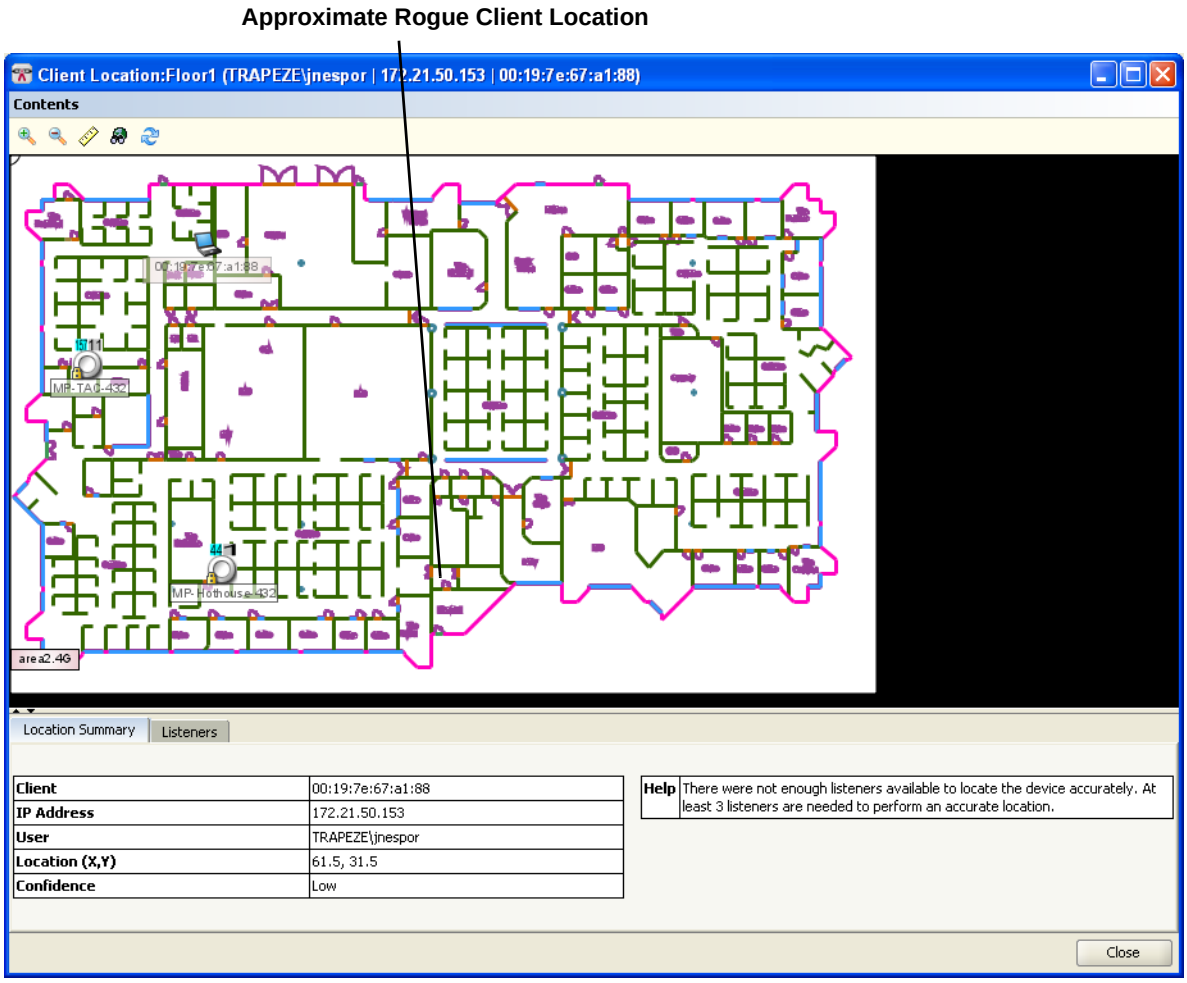
3. The **Client Location** screen appears, indicating the approximate location of the client


Approximate Rogue Client Location
Client Location:Floor1 (TRAPEZE\jnespor | 172.21.50.153 | 00:19:7e:67:a1:88)
Contents
Location Summary
Listeners
Client 00:19:7e:67:a1:88
IP Address 172.21.50.153
User TRAPEZE\jnespor
Location (X,Y) 61.5, 31.5
Confidence Low
Help There were not enough listeners available to locate the device accurately. At least 3 listeners are needed to perform an accurate location.
Close

4. To change the APs used for calculating the location of a client, click the **Listeners** tab and select or deselect APs from the list, then click (Locate).

Ignoring Friendly Third-Party Devices

By default, when countermeasures are enabled, MSS considers any third-party transmitter to be a rogue device and can send countermeasures to prevent clients from using that device. To prevent MSS from sending countermeasures against a friendly device, add the device to the Ignore list.

Each MX has an **Ignore** list. You can add an address to the **Ignore** list of one or multiple MXs.

To add a device to the **Ignore** list:

1. In the list of rogues on the **Alarm** screen, select the devices to add to the **Ignore** list.
    1. Click **Add to Ignore List** in the **Tasks** panel. The **Select Devices to Create Ignore list Entries** dialog is displayed.
2. If the MXs on which you are configuring an ignore list are in a Mobility Domain, select the Mobility Domain. Otherwise, select None.
3. Click next to **Select** to select all MXs listed, or click next to individual MXs to select them.

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4. Click **OK**. Devices are added to the ignore list and disappear from the list of rogues in the **Alarm** screen.

Adding a Device to the Rogue List

The rogue list is a list of AP MAC addresses belonging to a switch. *RingMaster* attacks the AP MAC addresses in the rogue list whenever they are present on the network.

1. From the list of rogues on the **Alarm** screen, select devices you want to place on the rogue list.
2. Click **Add to Rogue List** in the **Tasks** panel. The **Select Devices** dialog is displayed.
3. If the MXs on which you are configuring a rogue list are in a Mobility Domain, select the Mobility Domain. Otherwise, select **None**.
4. Click next to **Select** to select all MXs listed, or select individual MXs.
5. Click **OK**. Devices are added to the rogue list. If countermeasures are enabled, MSS uses them to attack devices on the list.

Converting a Rogue into a Third Party AP

If a device in the alarm list belongs to a third-party AP in your network, you can convert the rogue into a third-party AP. When you convert a rogue into a third-party AP, the rogue disappears from the alarm list, and allows you to place the AP in your network plan.

Converting a rogue into a third-party AP applies only to the network plan. RingMaster does not send this information in any form to the MXs in the network. To prevent MSS from issuing countermeasures against a third-party AP, you must also add the AP to the Ignore list. RingMaster does send the Ignore list to the MXs in the network.

To convert a rogue into a third-party AP:

1. In the **Alarm** screen rogues list, select the device you want to convert to a third-party AP.
2. Click **Create Third Party AP** in the **Tasks** panel. The **Third Party AP Properties** dialog is displayed.
3. Enter the information for the AP and place the icon for the AP in the floor location, if applicable. (See “Placing Third-Party Access Points” on page 105.) When you have finished, the AP appears under Objects to Place in RF Planning.
4. To display the list, select the **Configuration** option in *RingMaster* Navigation Bar and click on **Third Party APs** in the **Organizer** panel. Third-party APs are listed in the **Content** panel.

To remove a third-party AP:

1. Select the **Configuration** button on the *RingMaster* Navigation Bar and click on **Third Party APs** in the **Organizer** panel. Third-party APs are listed in the **Content** panel.
2. Select the third-party AP to remove and click the **Delete**. The address is removed from the third-party AP list. If a device is detected by rogue detection, it appears in the rogue list. Set the display filter of the **Rogue Detection** screen to **Current** and click the **Refresh** option on the toolbar.

Adding Clients Belonging to a Rogue to the Black List

The **Client Black List** is a list of MAC addresses belonging to wireless clients not allowed on the network. MSS prevents clients on the list from accessing the network through an MX.

1. In the **Alarm** screen, select the client to place on the **Black List**.

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2. Click **Add to Black List** on the toolbar. The **Select Devices** dialog is displayed.
3. Select the clients you want to add to the Black List. The **Select Devices** dialog is displayed.
4. If MXs on the Black List are in a Mobility Domain, select the Mobility Domain. Otherwise, select **None**.
5. Click next to **Select** to select all of MXs listed, or click next to individual MXs to select them.
6. Click **OK**. Selected clients are added to the black list. MSS drops all packets from these clients.

Configuring RF Detection Options from the Organizer Panel

Although the Rogue Detection tools provide a way to configure rogue detection features, you can also configure rogue detection settings for a single MX. See “Viewing and Changing RF Detection Settings” in the publication *RingMaster Configuration Guide*.

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RingMaster Reports

The **Reports** button on the *RingMaster* Navigation Bar enables you to generate reports for network clients, RF usage, rogue devices, and Trapeze equipment. Reports are grouped by feature and listed alphabetically in the Organizer panel.

RingMaster collects data from the network and stores it in a database on the server. You can also store reports on an FTP server in your network or store them locally. For each report, use the wizard to configure the report scope type, report scope instance, and time period settings. Some reports may require additional parameters. *RingMaster* generates a report and saves it on the server. To view the report, click the report link provided by the wizard.

Report Types

The following reports can be generated from RingMaster:

- **Alarms**
  - Alarm History
  - Alarm Summary
- **Audit**
  - Audit Trail
- **Availability**
  - AP Availability
  - AP Availability Details
  - SSID Availability
- **Configuration**
  - AP Inventory
  - Inventory
  - MX Configuration
  - Mobility Domain Configuration
- **Monitoring**
  - Degraded Network Uplink
  - Low Power PoE
  - Network Usage (Port Traffic)
  - Network Usage (Radio Traffic)

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- **PCI**
  - PCI Compliance
- **RF Planning**
  - Site Survey
  - Work Order
- **RF Spectral Interference**
  - RF Interference Detail
  - RF Interference Summary
- **Security**
  - Rogue Details
  - Rogue Summary
  - Security Alarms
- **Session Monitoring**
  - Client Details
  - Client Errors
  - Client Load by AP
  - Client OUI
  - Client Summary
- **SmartPass**
  - SmartPass Accounting Details
  - SmartPass Accounting Summary
  - SmartPass SMS and E-mail Notification
- **Voice**
  - Call Details
  - Call Summary

RingMaster uses a database to collect and store client, RF, and other system dynamic data, such as statistics, status, events, and traps. You can generate reports from the monitoring and configuration data collected in the database. When you generate a report, you specify a scope and time period for the report. Some reports also have additional options.

RingMaster saves both automatically and manually generated reports on the server in HTML format. You can also store reports on an FTP server in your network or store them locally. You can view a list of saved reports, view a report, delete a saved report, generate a new report, or schedule a report to be automatically generated and e-mailed.

Report Descriptions

Each type of report available is described in this section.

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All Report Type Item

Selection of this item displays All reports that have been generated, regardless of type. You can click on an individual report to view it.

Inventory Report

The inventory report lists the MXs and AP access points in a specific Mobility Domain or that do not belong to a Mobility Domain.

To generate an inventory report:

1. Select the **Reports** Navigation Bar button.
2. In the **Report Types** list, select **Inventory**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, choose the **Reports** section **Generate** item from the **Tasks** panel to display the **Generate Report > Inventory Report** dialog.
5. Select the scope type of the report from the **Report Options** area:
   - **Report Scope Type**
   - **Network Plan**
   - **Mobility Domain**

- **Report Scope Instance**

  Select the Report Scope Instance for which you want a report. For example, if the scope is Mobility Domain, select the Mobility Domain.

6. You can add report filters using fields and values in the **Report Filter** area.
7. Click **Next** to generate a report.
   1. When the report is generated, click the report link provided to view it in the default browser.

Table 1– 1 lists the sections in the Inventory Report.

Section	Description
Summary	Lists the equipment models and the number of each model in the network plan for the selected Mobility Domain.
Mobility Exchange Inventory	Lists information for each MX in the selected Mobility Domain.
Access Point Inventory	Lists information for each AP in the selected Mobility Domain.

Mobility Domain Configuration Report

A Mobility Domain Configuration Report lists information on all MXs in a Mobility Domain, including VLANs, radio/service profiles, RADIUS server groups, and servers configured on MXs.

To generate a Mobility Domain Configuration report:

1. Select the **Reports** Navigation Bar button.
2. In the Report Types list, select **Mobility Domain Configuration**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click **Generate** to display the **Generate Reports > Mobility domain Configuration Report** dialog.

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5. Select the scope type of the report from the **Report Options** area:
   - **Report Scope Type**
     - **Network Plan**
     - **Mobility Domain**
   - **Report Scope Instance**

   Select the Report Scope Instance for which you want a report. For example, if the scope is Mobility Domain, select the Mobility Domain.
6. Click **Next** to generate a report.
7. When the report is generated, click the Report link to view it in your default browser.

Table 1– 2 lists the sections in the report.

Section	Description
Mobility Exchanges	Name, model, and system IP address of each MX in the Mobility Domain. The number of directly attached and Distributed APs configured on each switch are also listed.
VLANs	VLANs configured on the MXs.
Radio Profiles	Radio profiles configured on the MXs.
Service Profiles	Service profiles configured on the MXs.
RADIUS Server Groups	RADIUS server groups configured on the MXs.
RADIUS Servers	RADIUS servers configured on the MXs.
APs	Lists information for each AP in the selected Mobility Domain.

MX Configuration Report

The MX configuration report lists configuration details for an MX.

1. Select the **Reports** Navigation Bar button.
2. In the Report Types list, select **MX Configuration**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click **Generate** to display the **Generate Reports > MX Configuration Report** dialog.
5. Select the scope type of the report from the **Report Options** area:
   - **Report Scope Type**
     - **Network Plan**
     - **Mobility Domain**
   - **Report Scope Instance**

   Select the MX for which you want a report.
6. Click **Next** to generate a report.
7. When the report is generated, click the report link to view it in the default browser.

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Table 1– 3 lists the sections in an **MX Configuration** report.

Section	Description
System Info	Name, system IP address, software, states of the management services, and states of active RF scanning and countermeasures.
Mobility Domain	System IP address of the seed for the Mobility Domain the switch is in.
10/100 Ports	10/100 Ethernet port settings configured on the switch.
Gig Ports	Gigabit port settings (if applicable) configured on the switch.
VLANs	VLANs configured on the switch.
Spanning Tree	STP settings configured on the switch.
IP Properties	IP settings, including routes and DNS parameters, configured on the switch.
ACLs	Access Control Lists (ACLs) configured on the switch.
APs	Directly connected APs configured on the switch.
Distributed APs	Distributed APs configured on the switch.
Radio Profiles	Radio profiles configured on the switch.
Service Profiles	Service profiles configured on the switch.
802.1X	802.1X parameters configured on the switch.
RADIUS	RADIUS server groups and servers configured on the MX.
Access Rules	AAA rules configured on the switch.
Mobility Profile	Mobility profiles configured on the switch.
Location Policy	Location policies configured on the switch.
Local User DB	Users configured in the local database.

Client Summary Report

The client summary report lists current client sessions.

To generate a client summary report:

1. Select the **Reports** Navigation Bar button.
2. In the Report Types list, select **Client Summary**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Report > Client Summary Report** dialog.
5. Select the scope type of the report from the **Report Scope Type** list:
   - **Mobility Domain**
   - **Mobility Exchange**
   - **Site**
   - **Building**
   - **Floor**
   - **Coverage Area**
6. Select the instance for the report. For example, if the scope is **Building**, select the building.
7. Click **Next** to generate the report.

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8. When the report is generated, click the report link to view it in the default browser.

   The client summary report contains the following sections:

   - **Session Summary**
   - **Total Num Sessions**
   - **Average SNR**
   - **Average RSSI**
   - **SSID Summary**
   - **Access Type Summary**
   - **Top Bandwidth Sessions**
   - **Low RSSI Sessions**
   - **Low SNR Sessions**

Client Details Report

The client details report lists details about current client sessions.

To generate a client details report:

1. Select the **Reports** Navigation Bar button.
2. In the Report Types list, select **Client Details**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Report > Client details Report** dialog.
5. Click **Add** to add a report filter. The filter configuration fields are activated.
6. Click **Select**, and select one of the following from the list:
   - **User Name**
   - **IP Address**
   - **MAC Address**
7. Click the **Value** field. Erase the text in the field and type a username, IP address, or MAC address of a user, depending on the selection criterion you specified in step 6.
8. Press **Next**.
9. Repeat step 5 through step 8 for each user you want to display details for.
10. Click **Next** to generate the report.
11. When the report is generated, click the report link to view it in the default browser.
12. The client details report contains the following sections:
    - **Session Properties**
    - **Location History**
    - **Session Statistics**
    - **Current AP Statistics**

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- **Lifetime AP Statistics**

Client Errors Report

The client errors report lists error statistics for current client sessions.

To generate a client errors report:

1. Select the **Reports** Navigation Bar button.
2. In the Report Types list, select **Client Errors**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Report > Client Errors Report** dialog.
5. Select the scope type of the report from the **Report Scope Type** list:
   - **Mobility Domain**
   - **Mobility Exchange**
   - **Site**
   - **Building**
   - **Floor**
6. **Coverage Area**
7. Select the instance for the report. For example, if the scope is **Building**, select the building.
8. Select the time period for the report:
   - **1 Hour**
   - **24 Hours**
   - **7 Days**
   - **30 Days**
9. Click **Next** to generate the report.
10. Click the report link provided to view it in the default browser.

The client errors report contains the following sections:

- **Cumulative errors for the scope of the report**
- **Client errors on individual MXs**

Top APs

To generate a **Top APs** report:

1. Select the **Reports** Navigation Bar button.
2. From the **Report Types** list, select **Top APs**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Report > Top AP Report** dialog.
5. Select the scope type of the report from the **Report Options** list:

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- **Report Scope Type**
  - **Network Plan**
  - **Mobility Domain**
  - **Mobility Exchange**
  - **Site**
  - **Outdoor Area**
  - **Floor**
- **Report Scope Instance**
- **Report Time Period**

SmartPass Accounting Summary

To generate a **SmartPass Accounting Summary** report:

1. Select the **Reports** Navigation Bar button.
2. From the **Report Types** list, select **SmartPass Accounting Summary**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click **Generate**.
5. Select parameters for the report from the **Report Options** list:
   - **Report Scope Type**
     - **Network Plan**
     - **Mobility Domain**
     - **Mobility Exchange**
   - **Report Scope Instance**
   - **Report Time Period**
6. Add a Report Filter if desired.
7. Click **Next**. The report is generated.

SmartPass Accounting Details

To generate a **SmartPass Accounting Details** report:

1. Select the **Reports** Navigation Bar button.
2. From the **Report Types** list, select **SmartPass Accounting Details.**
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click **Generate**.
5. Select parameters for the report from the **Report Options** list:
   - **Report Scope Type**
     - **Network Plan**
     - **Mobility Domain**

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  - **Mobility Exchange**
- **Report Scope Instance**
- **Report Time Period**

6. Add a Report Filter if desired.
7. Click **Next**. The report is generated.

SmartPass as an Integrated Application Server

SmartPass is now included as an application server under **Application Servers** in the Monitoring section of RingMaster. Selecting a SmartPass server displays server attributes and SmartPass license information. For SmartPass servers of versions lower than **Uptime**, **Version**, and **License Information** information is not available.

The following tasks are available after selecting a SmartPass server Organizer panel:

- Session Monitoring
- Accounting History
- Clients by Time
- SmartPass Accounting Summary report
- SmartPass Accounting Details report
- SmartPass SMS/Email Notifications report

Accounting History Data

RingMaster can display and print the accounting history data polled from all the configured (and managed) SmartPass servers. You must first supply information for the following fields used for filtering data:

- Username
- MAC address
- Date range (start date & end date)
- SSID name
- Location
- Quantity of bytes in/out
- Filter by throughput

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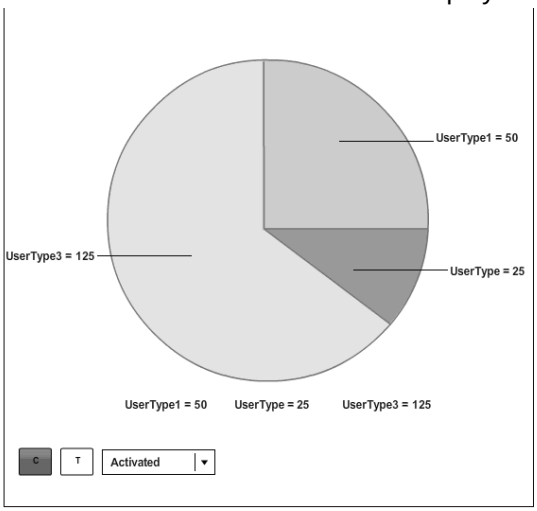
SmartPass Configured User State Display

The **Types** task under **Clients by User** launches a new pop-up window that contains a chart representing the distributed state of the configured users per user type. The data is polled from all the managed SmartPass servers and shown as one result. SmartPass configured users can exist in different states- **Activated**, **Expired**, **Unauthenticated** or **Locked**. RingMaster states can be chosen from a drop down list. You can also switch the results to be displayed in a table.



User Type	Client Count
usr-typ1	12
usr-typ2	9
usr-typ13	10

C T Expired

SmartPass New Reports

SMS/Email Notifications

This report displays the number of SMSs and email notifications sent per user type. The data is polled from all configured and managed SmartPass severs in RingMaster, version or above. A message displays if no SmartPass servers are present in the network plan. If the report is run from the Monitoring panel and the selected context is a single SmartPass server, the the data is polled only from that server.

Accounting Summary/Details

The SmartPass Accounting Summary/Details report has been enhanced to display the aggregated data from all configured and managed SmartPass servers.

Client Details

This report can be enhanced to show if the client was authenticated by a SmartPass server and the user type. This report includes voice data. If the report is run from the Monitoring panel and the selected context is a single SmartPass server, the data is polled only from that server.

Call Summary/Details

The calls data is polled from all configured (and managed) servers and aggregated in the same result.

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SmartPass Access Control

IfAccess Control is enabled on RingMster, only users who have administrative privileges or configuration/monitoring privileges at network plan level are able to manage/monitor a SmartPass server. During the process of uploading a SmartPass server in RingMaster, a check for administrative privileges prevents any management activity, if the credentials provided by the user do not correspond to an administrator account. The same thing happens when attempting to manage an unmanaged server through the **Edit SmartPass Server** task, or when synchronizing a managed server through the Synchronize task.

If access control is enabled on SmartPass, but the user and the password configured in RingMaster for a managed SmartPass server does not correspond to an administrator account (credentials may have changed since the moment of the upload), the Synchronize and Deploy operations fail. User names and password are always specified in the RingMaster request, so SmartPass is able to check if the credentials correspond to an administrator account and return an error response if they belong to a provisioning or self-signed account.

Network Usage (Port Traffic) Report

The network usage report lists network usage statistics.

To generate a network usage report:

1. Select the **Reports** Navigation Bar button.
2. From the **Report Types** list, select **Network Usage (Port Traffic)**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Report > Network Usage (Port Traffic) Report** dialog.
5. Select the scope type of the report from the **Report Scope Type** list:
   - **Network Plan**
   - **Mobility Domain**
   - **Mobility Exchange**
6. Select the **Report Scope Instance** for which you want the report. For example, if the scope is **Mobility Exchange**, select an MX.
7. Select the Report Time Period for the report:
   - **1 Hour**
   - **24 Hours**
   - **7 Days**
   - **30 Days**
8. Click **Next** to generate the report.
9. When the report is generated, click the report link to view it in the default browser.

Network Usage (Radio Traffic) Report

The traffic report shows traffic statistics and trends.

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To generate a traffic report:

1. Select the **Reports** Navigation Bar button.
2. From the Report Types list, select **Network Usage (Radio Traffic)**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Report > Network Usage (Radio Traffic) Report** dialog.
5. Select the scope type of the report from the **Report Scope Type** list:
   - **Network Plan**
   - **Mobility Domain**
   - **Site**
   - **Building**
   - **Floor**
   - **Distributed AP**
   - **AP**
   - **Radio**
6. Select the instance for which you want the report. For example, if the scope is Building, select the building.
7. Select the time period for the report:
   - **1 Hour**
   - **24 Hours**
   - **7 Days**
   - **30 Days**
8. Click **Next** to generate the report.
9. When the report is generated, click the report link to view it in the default browser.

RF Summary Report

The RF summary report lists summary RF statistics.

To generate an RF summary report:

1. Select the **Reports** Navigation Bar button.
2. In the Report Types list, select **RF Summary**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Report > RF Summary Report** dialog.
5. Select the scope of the report from the Report Scope Type list:
   - **Mobility Domain**
   - **Mobility Exchange**

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- **Site**
- **Building**
- **Floor**
- **Coverage Area**

6. Select the instance for which you want the report. For example, if the scope is Building, select the building.
7. Select the time period for the report:
   - **1 Hour**
   - **24 Hours**
   - **7 Days**
   - **30 Days**
8. Click **Next** to generate the report.
9. When the report is generated, click the report link to view it in the default browser. The RF summary report contains the following sections:
   - **Cumulative data for the scope of the report**
   - **Detailed data for each MX within the scope of the report**

Radio Details Report

The radio details report lists details about an individual radio.

To generate a radio details report:

1. Select the **Reports** Navigation Bar button.
2. In the Report Types list, select **Radio Details**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Report > RF Details Report** dialog.
5. Select a Report Scope Type in the pull-down.
6. Select a Report Scope Instance in the pull-down.
7. Select the time period for the report:
   - **1 Hour**
   - **24 Hours**
   - **7 Days**
   - **30 Days**
8. Click **Next** to generate the report.
9. When the report is generated, click the report link to view it in the default browser.

Radio Detail Report Changes

New columns have been added to this report

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Rogue Summary Report

The rogue summary report lists information about rogues.

To generate a rogue summary report:

1. Select the **Reports** Navigation Bar button.
2. In the Report Types list, select **Rogue Summary**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Report > Rogue Summary Report** dialog.
5. Select the scope type of the report from the Report Scope Type list:
   - **Mobility Domain**
   - **Site**
   - **Building**
   - **Floor**
6. Select the instance for which you want the report. For example, if the scope is Building, select the building.
7. Select the time period for the report:
   - **1 Hour**
   - **24 Hours**
   - **7 Days**
   - **30 Days**
8. To specify the rogue type, click on the Value field in the Report Filter area of the dialog, and select one of the following from the list:
   - **Rogue**
   - **Interfering**
   - **Ad-hoc**
   - **All** (This option displays all three types: rogue, interfering, and ad-hoc.)

   The default is Rogue.
9. Click **Next** to generate the report.
10. When the report is generated, click the report link to view it in the default browser.

The report lists the BSSIDs of the rogues detected by each MX. The report also shows graphs of the distribution of rogues on the MXs, and of trend data.

Rogue Details Report

The rogue details report lists detailed information about rogue devices.

To generate a rogue details report:

1. Select the **Reports** Navigation Bar button.
2. In the **Report Types** list, select **Rogue Details**.

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3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Report > Rogue Details Report** dialog.
5. Click **Add** to add a report filter. The filter configuration fields are activated.
6. Click on the **Select** field, and select **MAC Address**.
7. Click on the **Value** field. Erase the text in the field and type the BSSID of the rogue.
8. Press **Next** to complete the filter.
9. Repeat step 5 through step 8 to display details for each user.
10. Click **Next** to generate the report.
11. When the report is generated, a dialog appears that has a link to the report.

Click the report link to view the report in the default browser. The illustration below shows three sections of the report as it is scrolled to show all features.

Alarm Summary Report

The alarm summary report provides a summary of alarms.

To generate an alarm summary report:

1. Select the **Reports** Navigation Bar button.
2. In the Report Types list, select **Alarm Summary**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Reports** dialog.
5. Select the scope type of the report from the **Report Scope Type** list:
   - **Network Plan**
   - **Mobility Domain**
   - **Site**
   - **Building**
   - **Floor**
6. Select the instance for which you want the report. For example, if the scope is **Building**, select the building.
7. Click **Next** to generate the report.
8. When the report is generated, click the report link to view it in the default browser.

Alarm History Report

The alarm history report provides a history of alarms.

To retrieve fault history:

1. Click **Alarm History** in the **Tasks** panel under **Reports**.
2. *RingMaster* displays the **Alarm History** dialog box. You can sort history using any of the following fields:

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- **Report Scope Type**
- **Report Scope Instance**
- **Start date**
- **Start time**
- **End date**
- **End time**

3. Click **Next** to see the **Generate Report** dialog, which gives you a link to the final report.

An example report looks like this:

Security Report

The security alarm report provides information about security alarms.

To generate a security alarm report:

1. Select the **Reports** Navigation Bar button.
2. In the Report Types list, select **Security**.
3. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Report > Generating Security Report** dialog.
4. When the report is generated, click the report link to view it in the default browser.

Client OUI Report

The client OUI report provides information about client-related alarms.

To generate a Client OUI report:

1. Select the **Reports** Navigation Bar button.
2. In the **Report Types** list, select **Client OUI**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Report > Generating Client OUI Report** dialog.
5. When the report is generated, click the report link to view it in the default browser.

Site Survey Order

The site survey order contains the locations and MAC addresses of the line-of-site (LOS) points for use when conducting a site survey, and also provides a GIF image of the floor.

For a site survey order to be meaningful, you must specify the line-of-site (LOS) points first. (See “Importing RF Obstacle Data from a Site Survey” on page 82.)

To generate a site survey order:

1. Select the **Reports** Navigation Bar button.
2. In the **Report Types** list, select **Site Survey Order**.

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3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Report > Generate Site Survey Order Report** dialog.
5. Select the scope for the work order. You can select the network plan, a site, a building, or an individual floor.
6. Select the language:
   - **English**
   - **German**
7. Click **Generate** to generate the report.
8. When the report is generated, click the report link to view it in the default browser.
9. Optionally, select the floor.
10. Click **View Site Survey Order**. The site survey order appears. LOS point information for the selected floor is displayed. Scroll down to view the MAC address assignments for the LOS points. Use the instructions in the Ekahau Site Survey Initial Setup section of the work order to set up the survey.

When you import the floor map into the site survey tool, make sure you use the map name specified in the work order. The site survey data does not appear when you import RF measurements into RingMaster unless the map name is correct.

Work Order

A work order provides all of the necessary information for the physical installation of the Trapeze Mobility System. A work order shows where the AP access points should be installed, MX initial setup configuration information, and projected RSSI information that is useful when verifying the installation.

A work order has meaning only after adding planning information. (See the publication *RingMaster Planning Guid*e.)

Work Order and Rogue detail reports can be only generated and viewed. These reports do not go into the report list in the main panel.

To generate a work order:

1. Select the **Reports** Navigation Bar button.
2. In the **Report Types** list, select **Work Order**.
3. To view an existing report, click on its name and select **View** in the **Tasks** panel.
4. To generate a new report, click the **Generate** item from the **Tasks** panel to display the **Generate Work Order Report** dialog.
5. Select the scope for the work order. You can select the network plan, a site, a building, or an individual floor.
6. Select the options you want to use for the report:
   - **RF Coverage —** if selected the following options are available:
     - **Show RF Coverage On Entire Floor**
   - **RSSI Projections** — if selected the following options are available:

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- **Show Disabled APs**
- **Show RF Coverage On Entire Floor**
- **Show Unreachable APs**

- **Show APs on Other Floors**
- **RSSI Heat Map on Entire Floor**

7. Select the language:
   - **English**
   - **German**
8. Click **Generate** to generate the report.
9. When the report is generated, click the report link to view it in the default browser.
   2. You can use links in the report to review desired items.

The origin reference point used in work orders to indicate AP placement is the upper left corner of the coverage area. (Typically, this origin point does not match the origin point used on the floor plan.)

Work Order Report Changes

Work Order reports include the following new information:

- Power information for MP-432.
- Zone information

Monitoring Requirements for Reports

Some reports require specific monitoring options to be enabled in *RingMaster Services*. **Table 1– 4** lists these requirements for each report type.

Category	Report	Monitoring Option Requirement
Configuration	Inventory	None. Information comes from the network plan.
	Mobility Domain Configuration	
	MX Configuration	
Client monitoring	Client Summary	Enable Client Session Collection
	Client Details	
	Client Errors	
Traffic	Network Usage (Radio Traffic)	Enable Traffic & RF Trending
	Network Usage (Port Traffic)	
RF Information	RF Summary	Enable Traffic & RF Trending and RF Threshold Settings
	Radio Details	
Rogue	Rogue Details	Enable Rogue Detection
	Rogue Summary	
Alarm	Alarm Summary	None. Information comes from SNMP. Traps must be enabled on the MXs and RingMaster Services must be enabled as a trap receiver.
	Alarm History	
	Security	
	Client OUI	

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Category	Report	Monitoring Option Requirement
RF Planning	Site Survey Order	None. Information comes from the network plan.
	Work Order	

Viewing Reports

To view or delete saved reports:

1. Select the **Reports** Navigation Bar button.
2. In the **Organizer** panel, select **Report Types** to display a list of saved reports. Select **All** in the Organizer panel to display a list of all saved reports.
3. Click on a report and click **View** in the **Tasks** panel option list to display the selected report in your default browser.

   or

4. To delete the selected report from the saved reports directory on the server, select a report and click **Delete** from the **Tasks** panel option list.

Saving a Report

To save a report to your local hard drive:

1. Select the **Reports** Navigation Bar button.
2. In the **Organizer** panel, select a **Report Type** to display a list of saved reports. Select **All** in the Organizer panel to display a list of all saved reports.
3. Select a report from the **Saved Reports** panel. (If there are no saved reports, the Content panel displays an empty table.)
4. Choose **Reports > View** from the **Tasks** panel option list to display the selected report in your default browser.
5. Choose **File > Save As...** from the browser menu.
6. Navigate to the directory in which to save the report.
7. To rename the file, enter a new name in the **File name:** field.
8. Select the **Web page, complete** option from the **Save as type:** list.
9. Click the **Save** button to save the report. Images used in the report are saved in a folder named "*reportName*_files" in the directory selected in Step 6.)

To generate an updated report, select an alarm and click **Generate**.

Storing a Report on a FTP Server

To store a report locally or on an FTP server in your network:

1. On the **Reports** page, click **Report Settings**.
2. To configure the FTP Server Info, you need to enter the following information:
   - **IP Address** — The IP address of the FTP server
   - **Port** — the default port is 21.
   - **User Name** — The username to log into the FTP server (if required).

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- **Password** — The password for the FTP server (if required).

Once you have entered the FTP Server Info, you can test the connection by clicking Test FTP Setting.

You can also purge locally stored reports by configuring the interval, in days, to delete them from the RingMaster server. The default value is 10 days.

There are two available formats for RingMaster reports:

- HTML
- PDF

3. Select the format from the **Report File Type** list.
4. Click **OK** to save the settings.
5. Click **Generate Report** to configure the options for the report format.

Scheduling and E-mailing Reports

Selected network reports can be generated automatically according to a user-defined schedule. Automatically generated reports appear in the Reports panel. When a report is scheduled, you can manage the attributes of the schedule and choose to have it e-mailed to recipients on a mailing list created using the **Schedule** task. You can create different schedules and mailing lists for different reports.

The following reports can be automatically generated and distributed by e-mail:

- **Inventory**
- **Network Usage (Radio Traffic)**
- **Network Usage (Port Traffic)**
- **Alarm Summary**
- **Security**
- **Client OUI**

To schedule and e-mail a report:

1. In the **Tasks** panel, under **Create**, click **Schedule**. The **Report Schedule** wizard is displayed. Create a name for the schedule and enter it in the **Schedule Name** field. The report is enabled by default. To disable the Report Schedule, clear the **Enabled** checkbox.
2. Click **Next**.
3. From the **Schedule Type**, select one of the following types:
   - One Time - the Report Schedule runs once at the scheduled time.
   - Recurring - the Report Schedule runs at the designated times.

   If you select Recurring, then you can select specific days and times to run the report as well as the range of the schedule.
4. Click **Next**.
5. Configure the **Report Type**, either HTML or PDF. If you want the report e-mailed to you, select **E-mail Enabled**, and enter your e-mail address. You can also select the e-mail format for the report, either as a hyperlink or a PDF.
6. If you want to copy the report to an FTP server, select Copy to FTP Server.

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7. Click **Next**.
8. If you have configured any **Report Definitions**, you can include them here.
9. Click **Finish** to complete the configuration.

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Working with Network Plans

A network plan is identified by a button in the **Organizer** panel of the *RingMaster Client* main window. A network plan is at the top of a hierarchy containing all sites and system elements of a network, each with an icon that allows selection of configuration and operational settings, monitoring, etc. Network elements include MXs, AP access points and optionally, third-party access points. You must create a network plan before you can configure or manage MXs or monitor network data.

A network plan allows modular management of large networks based on organizational or geographical boundaries. For example, a network plan can represent a campuswide network. If you install a license *RingMaster* key for RF planning, you can define a physical representation of network sites, buildings, and floors. You can import drawings of floor plans into a network plan or draw plan details manually. You can identify RF characteristics by importing data from a site survey or manually by identifying RF objects. You should limit a network plan to a single campus or Mobility Domain (Trapeze network domain).

Regulatory limits for 802.11 radios very in different countries. Setting a country code in a network plan enforces appropriate regulatory limits for configured radios. The greatest geographical scope for a network plan is a country, because a network plan is based on one country code.

Managing Network Plans

After creating a network plan, you can save, close, open, or delete it. You can also share a network plan with others.

Saving a Plan

When you create a network plan and save changes, a directory with the same name as the network plan is created in the **config-db** directory of the *RingMaster* installation directory on the *RingMaster Services* host. Each time you save a configuration change, *RingMaster* saves changes to a network plan. You do not need to explicitly save a network plan itself. However, if a network plan has unsaved changes when you select to exit *RingMaster* or close a network plan, *RingMaster* displays a prompt asking if you want to save or discard changes, or cancel the request. (See “Saving or Discarding Configuration Changes” in the publication *RingMaster Configuration Guide*.) (In addition to this section, see “Managing Network Plans” in the publication *RingMaster Management Guide*.)

You should regularly back up the **config-db** directory so that you have additional copies of your network plans.

If a plan has unsaved changes and *RingMaster Services* becomes unavailable before the changes are saved, *RingMaster Client* buffers the changes until *RingMaster Services* becomes available again. However, for the changes to be buffered, you must leave your *RingMaster Client* session open and leave the network plan open.

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Saving a Network Plan with a New Name

You can save a network plan with a new name by using the **Save As** feature.

To save a network plan with a new name:

1. Select **Services > Plan Management** to access the **RingMaster Plan Management** page in your default browser.
2. Click **Save As** in the left column to display the **Save As Network Plan** page.
3. In the **Network Plan Name** field, type a name for the network plan. You can use 1 to 60 alphanumeric characters, with no spaces, tabs, or any of the following: slash (/), backslash (\), quotation marks (“ ”), asterisk (*), question mark (?), angle brackets (< >), or vertical bar (|). To place the name of an existing plan into the **Network Plan Name** field, click the button next to the name of the network plan, and then click **Select**.
4. Click **Save** to save the network plan with the new name.

Opening a Plan

Network plans reside on a system running *RingMaster Services*. You can open an existing network plan by connecting to the *RingMaster Services* host where the plan resides, selecting **Services > Plan Management**, then specifying the name of plan in the **Switch Plan** page. The network plan is then opened in the *RingMaster* main window.

You can open a network plan created in a previous version of *RingMaster* with a later version of *RingMaster*. For example, if you created a network plan in *RingMaster 5.0*, you can open the plan in *RingMaster* . However, because a network plan created in *RingMaster 5.0* manages MXs running *MSS 5.0*, you cannot use new features available in *MSS 7.0* unless you upgrade the MXs to *MSS 7.0*. (To upgrade MXs, see “Distributing System Images” in the publication *RingMaster Management Guide*.)

To open a network plan:

1. Establish a connection to the *RingMaster Services* host on which the network plan is saved. You can do this by restarting **RingMaster** or selecting **File > Connect,** and then entering the IP address of the *RingMaster Services* **host in the RingMaster Services Connection** dialog box.
2. After a connection is established with the *RingMaster Services* host, select **Services > Plan Management** to access the **RingMaster Plan Management** page.
3. Click **Switch Plan** in the left column to display a list of available network plans.
4. Select the network plan you want to open and click **Switch**. If any changes were made to the currently loaded network plan, you are prompted to save them and close the file. The **Switch Network Plan** dialog box appears. *RingMaster* establishes a new connection to the host running *RingMaster Services* and loads the specified network plan.

Importing a Plan

You can import objects from another network plan into the currently open plan. When you import objects from another plan, objects are added to the currently open plan as follows:

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If an object (object name) exists in the plan you are importing but not in the open plan, the object is added to the open plan. If an object (object name) exists in both plans, the copy of the object in the imported plan replaces the object in the open plan.

If both plans have the same floor name, the floor in the plan you are importing completely replaces the floor of the same name in the other plan. You should save a backup copy of the plan before importing objects from another plan. To save a backup copy, use the **Save As** page.

To import a plan:

1. Select **Services > Plan Management** to access the **RingMaster Plan Management** page.
2. Click **Import Plan** in the left column to display the **Import Plan** page.
3. Select the network plan you want to import, from the **Plan** pull-down list. *RingMaster* compares object names in a plan to be imported with object names in the open plan. If both plans have objects of the same name and type, the objects are listed and **Conflict** appears in the **Status** column.
4. Do one of the following, depending on whether you want to import all objects from the plan:
   a. If you do not want to replace the objects in the open plan with their like-named objects in the other plan, click Cancel. RingMaster does not import any objects from the plan.
   b. If you do want to replace the objects, click Import. RingMaster imports the objects into the open plan.

Closing a Plan

You can close a network plan at any time. If you have unsaved changes, you are asked whether you want to save the changes.

To close a network plan:

1. In the main *RingMaster* window, select **File > Close** or **File > Exit**. If the network plan has no unsaved changes, the network plan is closed. Otherwise, go to the next step.
2. If there are unsaved changes, *RingMaster* displays a dialog asking whether you want to save changes, discard them, or cancel the request to close the plan or exit the application.
3. Do one of the following:
   - Select **Apply** to save the changes and close the plan.
   - Select **Discard** to close the plan without saving the changes.
   - Select **Cancel** to cancel the request to close the plan or exit the application, and continue working with the plan.

Deleting a Plan

You can delete a network plan at any time.

You cannot delete the currently active plan. To delete the active plan, first use the **Switch Plan** page to select another plan to be active, then delete the plan.

To delete a network plan:

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1. Select **Services > Plan Management** to access the **RingMaster Plan Management** page.
2. Click **Delete Plans** in the left column to display the **Delete Plans** page.
3. Select one or more the network plans from the list.
4. Click **Delete**. The network plan is deleted.

Sharing a Plan

Since the *RingMaster* plan repository resides on a networked server (the host running *RingMaster Services*), you can share access to network plans among hosts running the *RingMaster Client*. When you make changes to a network plan, *RingMaster* locks the portion of the plan you are modifying. Other *RingMaster* clients can open the network plan, but the lock prevents them from modifying the part of the plan you are modifying. The lock remains in effect until your modification is saved. *RingMaster* then removes the lock.

When a user with an administrator or provision account tries to access a part of a plan already locked by another user, *RingMaster* displays a **Lock Info** page. This **Lock Info** page indicates who has locked the network plan. You can optionally override a user's lock. Note that only a user with Administrator privileges can override another user's lock.

To override another user's lock:

1. Select **Services > Lock Management** to access the **RingMaster Lock Information** page. A list of objects that are locked appears.
2. Select the object whose lock you want to delete and click **Delete**. (Only an Administrator can delete a lock.)
3. A message is displayed indicating that the user whose lock you selected cannot save their changes when you delete their lock. Click **Yes** to confirm that you want to do this.

If you override a lock, *RingMaster* unlocks the part of the plan that was locked, and notifies the other *RingMaster* users about the lock change. From this point on, the former lock holder cannot save changes to the previously locked portion of the plan.

By default, *RingMaster* sends a message to all users with the plan open to inform them when changes are saved to a plan. In addition, *RingMaster* sends a message to each monitor user, so that one of them can then edit the plan.

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Spectrum Analysis and RF Interference

WLAN networks send traffic over 2.4- and 5-GHz bands. Many devices, such as microwave ovens, cordless phones, and Bluetooth devices also operate in these bands and can negatively affect Wi-Fi operations. Advanced WLAN services, such as voice over wireless (VoIPw) and IEEE 802.11n radio communications, can be significantly impaired by the interference caused by users of the same bands. The implementation of Spectrum Analysis into RingMaster Network Management Software addresses the issue of radio frequency (RF) interference. The Spectrum Analysis feature, available in MSS and RingMaster Version 7.5, enables you to identify and track non-Wi-Fi sources of interference, adjust your network configuration for optimal performance, identify threats from malicious devices, and allow your WLAN to coexist with other wireless devices.

To use the Spectrum Analysis feature in RingMaster, you must have an Advanced Monitoring license and also WLA522s or WLA522Es installed in your network. The WLA522 series APs collect information about all devices that operate in the wireless bands, identify and evaluate the information as a potential interference source, and forward it to WLC The WLC controls the access points, collects spectrum data, and allows RingMaster to display the information graphically. The WLC is used to configure basic Spectrum Analysis features and display basic spectrum information. RingMaster provides the capability for configuring, advanced SA features, displaying information graphically, and generating reports.

There are two parts to using this feature in RingMaster:

- Detecting RF interference by scanning the network using the Monitoring feature in RingMaster to display spectrum graphing and classifying sources of interference.
- Placing sources of RF interference on your network plan, and then using the Compute and Place to optimally install or move APs on the network.

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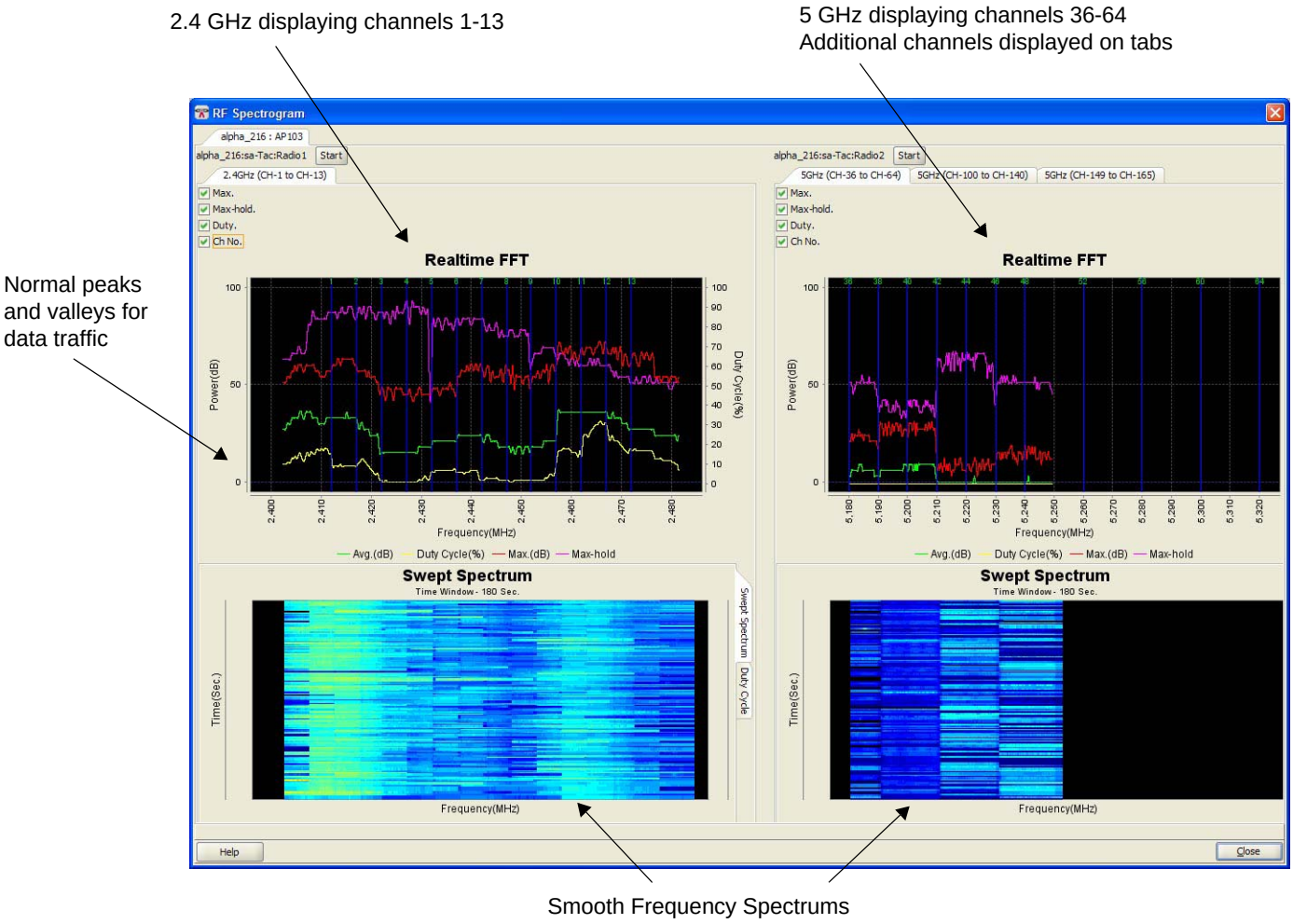
Customer Scenario I - Troubleshooting Wireless Connectivity

A large university implemented the WLS solution over a outdoor campus and multiple buildings using numerous WLCs and WLAs. The university IT department uses RingMaster for RF Planning and places WLA522s appropriately around the campus for the best wireless coverage and client access. Students and faculty can access the network and teach classes using wireless connectivity on their laptops and send lesson plans to students via e-mail. RingMaster is also configured to send alarms via e-mail to the network administrator. Running Spectrum Analysis to evaluate the network for interference reveals no interference.



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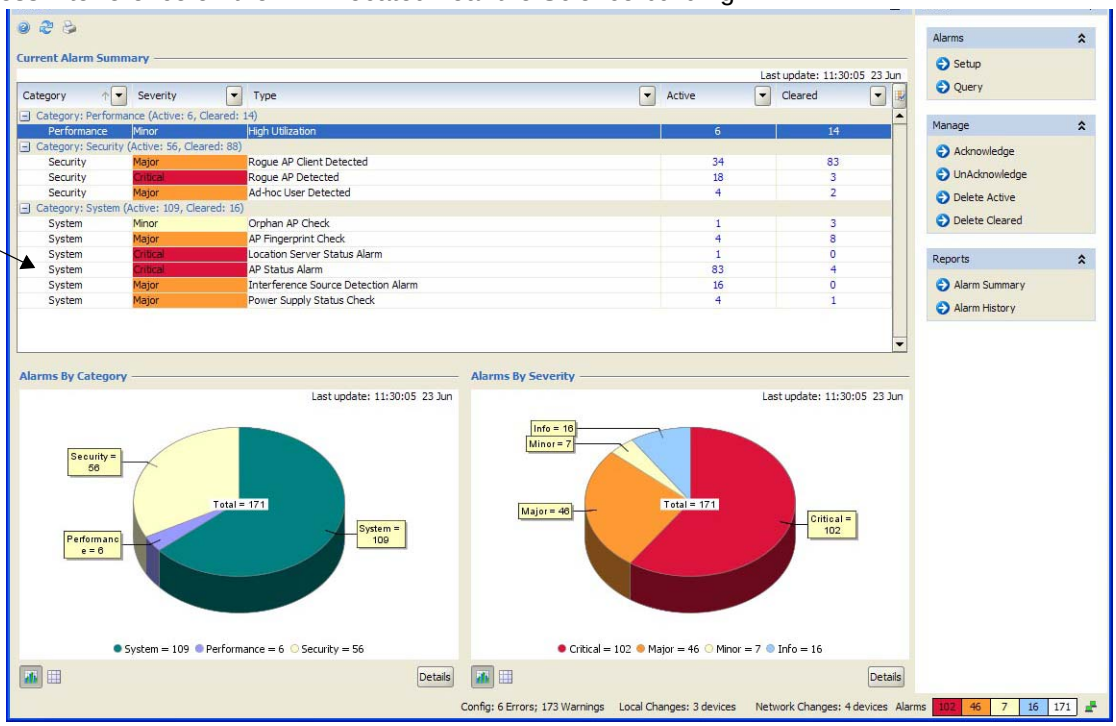
After a few months, a classroom in the Science building reported multiple issues with wireless connectivity including service interruptions on a periodic basis. The WLA522s were configured with a radio-profile that included spectrum analysis running in sentry mode to concurrently scan for interference on the WLAN. At the time of the service interruptions, RingMaster sent alarms to the IT personnel that a device was causing wireless interference on the WLA located near the Science building.

Interference Alarrn



Once the alerts were sent, the network administrator used the Spectrum Analysis feature within RingMaster to determine the location of the interfering device and the type of device causing interference.

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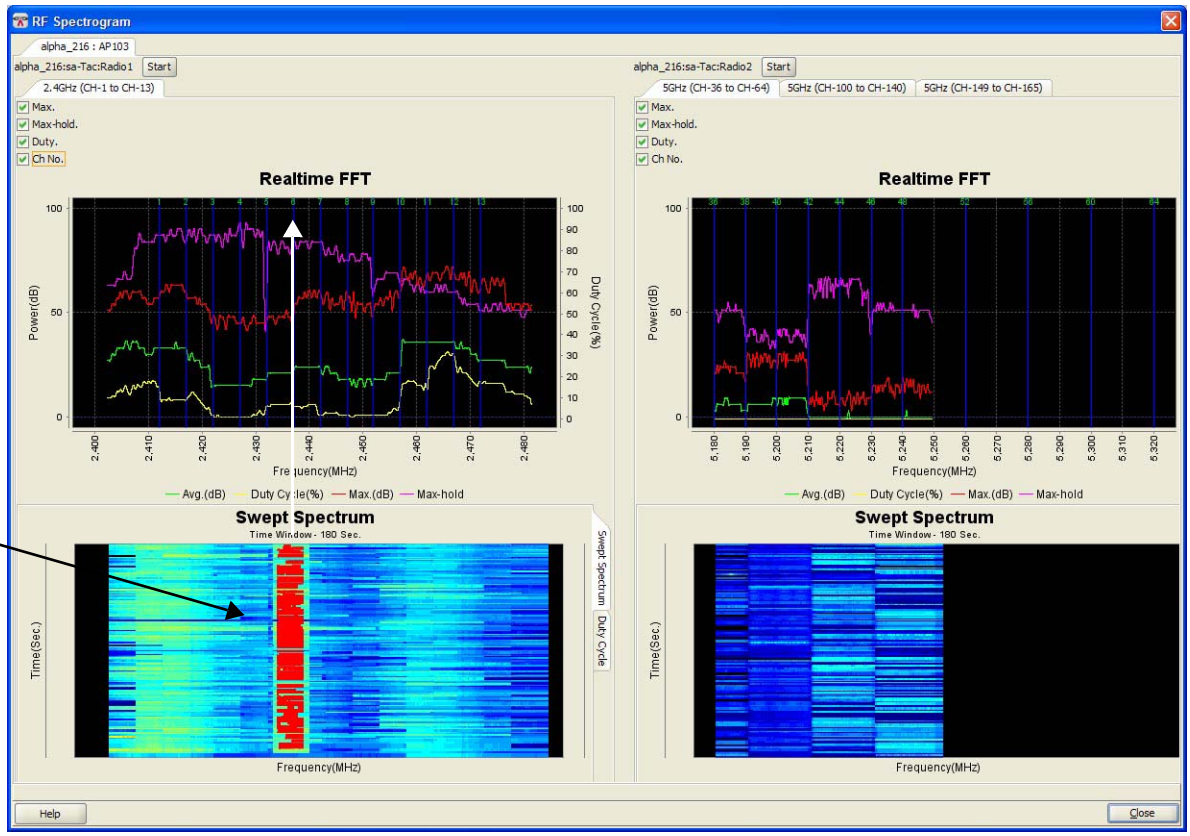

Spectrum Display of Interference

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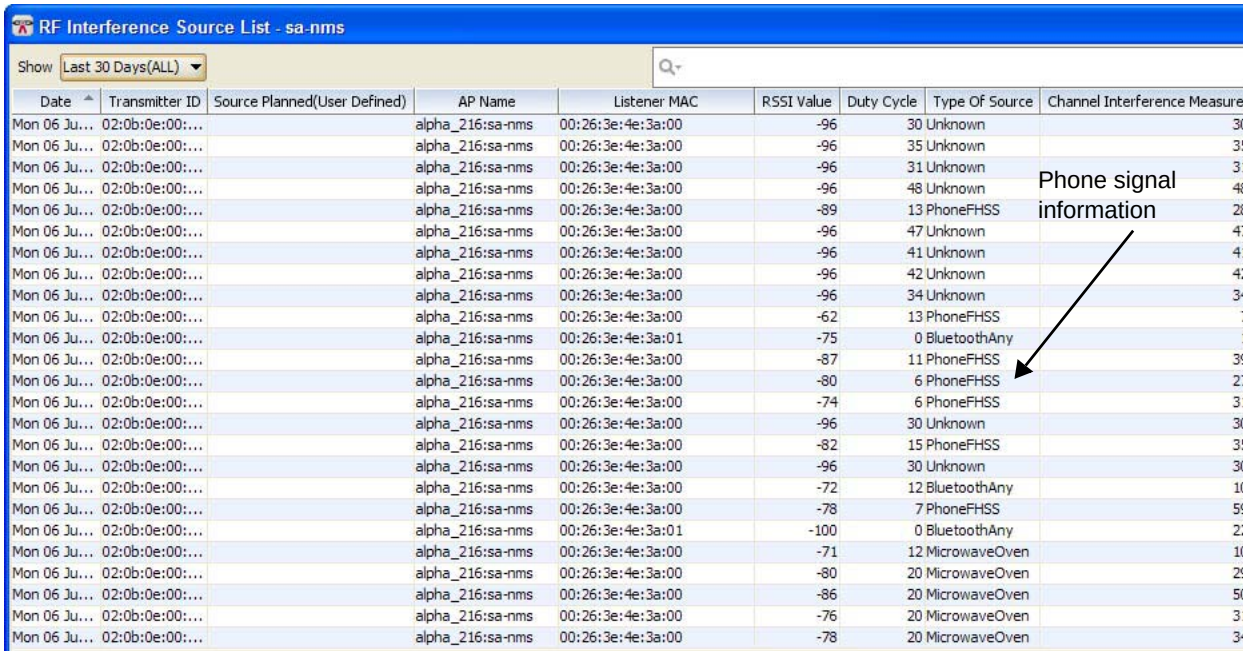
By examining the RingMaster Spectrum Analysis data, and using the Interference Sources feature, the network administrator was able to pinpoint a newly installed cordless phone as the interference source speicifically on Channel 6 of the 2.4 GHz radio.



Date	Transmitter ID	Source Planned(User Defined)	AP Name	Listener MAC	RSSI Value	Duty Cycle	Type Of Source	Channel Interference Measure
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	30	Unknown	3
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	35	Unknown	3
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	31	Unknown	3
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	48	Unknown	4
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-89	13	PhoneFHSS	2
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	47	Unknown	4
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	41	Unknown	4
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	42	Unknown	4
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	34	Unknown	3
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-62	13	PhoneFHSS	
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:01	-75	0	BluetoothAny	
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-87	11	PhoneFHSS	3
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-80	6	PhoneFHSS	2
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-74	6	PhoneFHSS	3
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	30	Unknown	3
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-82	15	PhoneFHSS	3
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	30	Unknown	3
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-72	12	BluetoothAny	1
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-78	7	PhoneFHSS	5
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:01	-100	0	BluetoothAny	2
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-71	12	MicrowaveOven	1
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-80	20	MicrowaveOven	2
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-86	20	MicrowaveOven	5
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-76	20	MicrowaveOven	3
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-78	20	MicrowaveOven	3

Customer Scenario II - Using RF Planning to Place Sources of Wireless Interference

The local hospital has purchased a Patient Monitoring solution that requires stable wireless connectivity so that patient vital information can be transmitted to nurses' stations and wireless laptops and tablets carried by healthcare professionals. It is crucial to the network that instances of wireless interference has little or no impact on the connectivity to patient monitoring.

During the planning process using RingMaster RF Planning, several sources of wireless interference are discovered on the floor. In the Visitors waiting room, a small microwave is provided as a convenience to visitors who may experience long waiting periods and want to warm coffee or water for tea. At every nurses' station, a cordless phone is provided so nurses can answer calls while performing other tasks.

After importing the floor plan into the RingMaster network plan, the network administrator uses the Interference icons to identify the location of potential wireless interference. The Interference icons can be configured as cordless phones, microwaves, video cameras, and Bluetooth. Once the icons are placed, the Compute and Place feature of RF Planning calculates the number of WLAs necessary for wireless coverage and recommends the placement of the WLAs on the ceiling of the floor.

See "Planning for RF Interference on the Wireless Network" in this document.

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General Spectrum Analysis Features

Detecting RF Interference on the Wireless Nework

To detect RF Interference on the network, open RingMaster and perform the following steps:

1. In the **Organizer** panel, open your network plan at the **Sites** level.
2. Select a **WLA522** from the Organizer panel.
3. Click **Monitor** in the Main Navigation bar.
4. Click **Show Spectrograph**.
5. When you select **Show Spectrograph**, a message is displayed that warns you about dropping all client connections on the WLA. Click **Yes** to continue to the Spectrograph.
6. Two spectrographs are displayed for each radio:
   - **Realtime FFT (MHz)** - the percentage of samples that were at least 20 dB above the noise floor on that channel.
     - Power (dB) - displays the amount of power from 0 - 100 on the y-axis
     - Duty Cycle - the amount of RF energy present in the spectrum
   - **Swept Spectrum (MHz) / Duty Cycle -** the percentage of time that a transmission from a known device is present in the channel or band.

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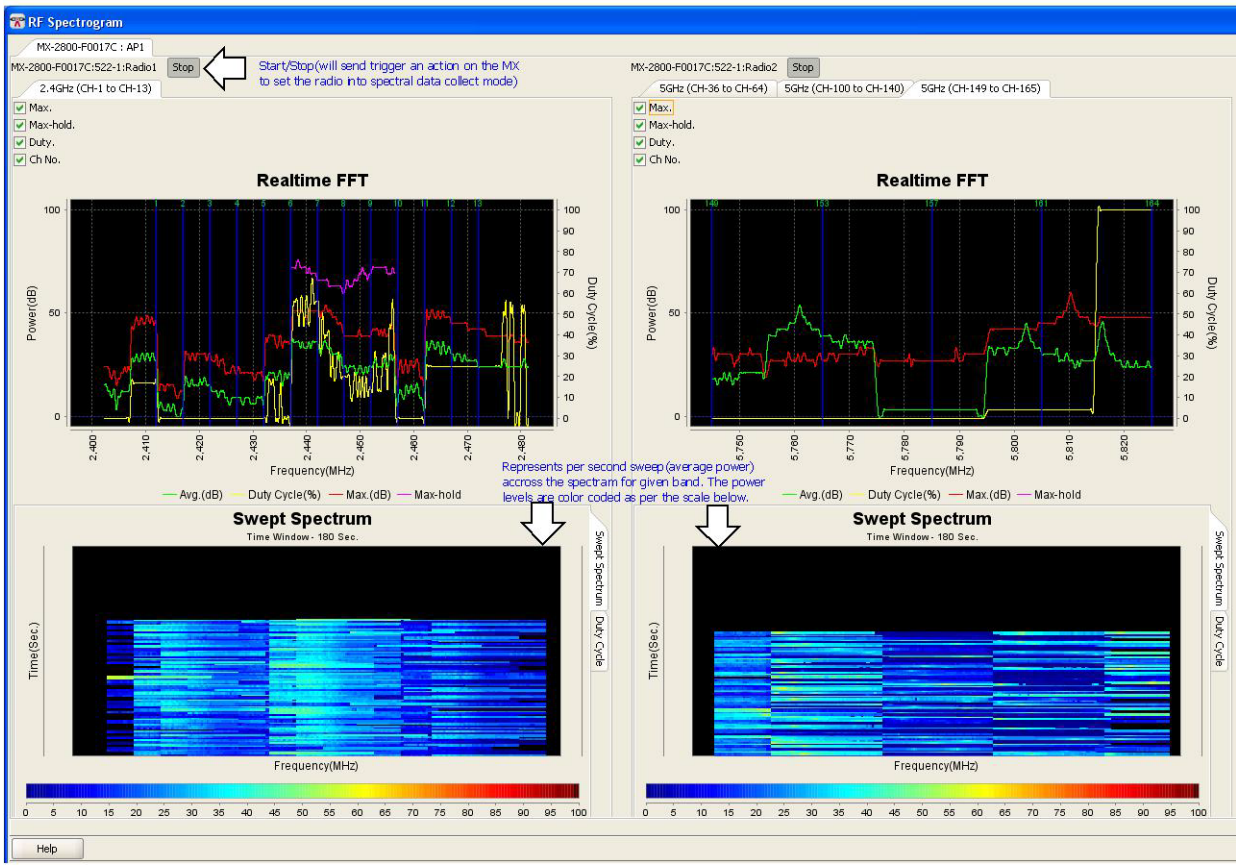
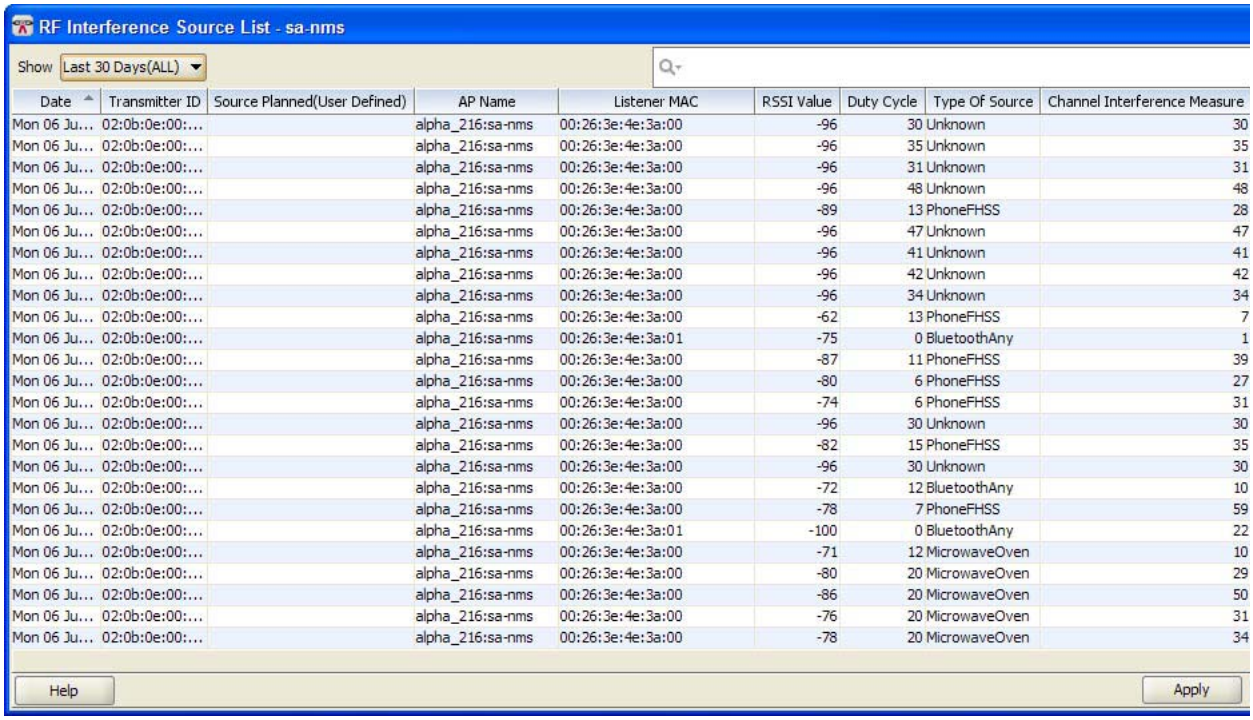
7. Click **Start** to begin scanning for interference.



8. After scanning the network, click **Stop**

9. Click Interference Sources to display detailed information about interference sources on the network.



Date	Transmitter ID	Source Planned(User Defined)	AP Name	Listener MAC	RSSI Value	Duty Cycle	Type Of Source	Channel Interference Measure
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	30	Unknown	30
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	35	Unknown	35
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	31	Unknown	31
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	48	Unknown	48
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-89	13	PhoneFHSS	28
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	47	Unknown	47
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	41	Unknown	41
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	42	Unknown	42
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	34	Unknown	34
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-62	13	PhoneFHSS	7
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:01	-75	0	BluetoothAny	1
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-87	11	PhoneFHSS	39
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-80	6	PhoneFHSS	27
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-74	6	PhoneFHSS	31
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	30	Unknown	30
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-82	15	PhoneFHSS	35
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-96	30	Unknown	30
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-72	12	BluetoothAny	10
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-78	7	PhoneFHSS	59
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:01	-100	0	BluetoothAny	22
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-71	12	MicrowaveOven	10
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-80	20	MicrowaveOven	29
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-86	20	MicrowaveOven	50
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-76	20	MicrowaveOven	31
Mon 06 Ju...	02:0b:0e:00:...		alpha_216:sa-nms	00:26:3e:4e:3a:00	-78	20	MicrowaveOven	34

The following information is displayed:

- **Date** - the date that the device was seen on the networikl
- **Transmitter ID** - the MAC address of the radio on the wireless device
- **Source Planned (User Defined)** - Interference Sources placed on the network plan
- **AP Name** - name of the AP detecting the interference source
- **Listener MAC** - the MAC address of the AP radio
- **Channel** - the radio channel where the interference source was detected.
- **RSSI Value** - the signal strength of the interference source
- **Duty Cycle** - the number of cycles that displayed the interference source
- **Type of Source** - classification of the interference source such as cordless phone, microwave, bluetooth devices
- **Channel Interference Measure (CIM)** - the amount of degredation on the channel due to the interference source
- **Last Seen** - the timestamp of the last occurance of interference.

Planning for RF Interference on the Wireless Network

To plan for interference or place Interference icons on your network plan:

1. Select **RF Planning** option in the main *RingMaster* menu bar.
2. Display a floor plan in the **Content** panel.

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3. In the Tasks panel, click **Tools**.
4. Under **RF Sources/Misc**, click the Interference icon, and drag it to the approximate location of the interference source. An interference source can be one of the following:
   - **Bluetooth** - devices using Bluetooth to connect to other Bluetooth devices
   - **Microwave** - microwave ovens located in a breakroom or nearby cafeteria can cause interference on the wireless network.
   - **Wireless phones** - cordless phones are also a source of interference.
   - **Video Cameras** - security cameras sending monitoring video over the wireless network.
5. When you place the Interference Source icon on a layout, the **Create Interference Source** wizard is displayed. Enter the following information:
   - **Name** - create a unique name for the source.
   - **Interference Type** — Microwave Oven, Bluetooth, Cordless Phone 1, Cordless Phone 2, or Custom
   - **Frequency of Operation** — 2.4 GHZ or 5 GHZ
   - **Channels of Operation** — select from Channel 1 to Channel 11
   - **Duty Cycle** — select the amount in percentage from 0 -100%.
   - **Hours of Operation** — select the hours in 1 hour or more increments.
6. Click **Next**.
7. Enter the approximate RF power associated with each channel.
8. You can optionally save the settings as a custom **Source Interference Type**. Select **Save As Custom Interference Type**, and from the **In Category** list, select one of the following categories:
   - **Unknown**
   - **Continuous-wave**
   - **Pulsed or intermittent**
   - **Frequency-hopping radio**
   - **Other packet radio**
9. Click **Finish** to complete the configuration.

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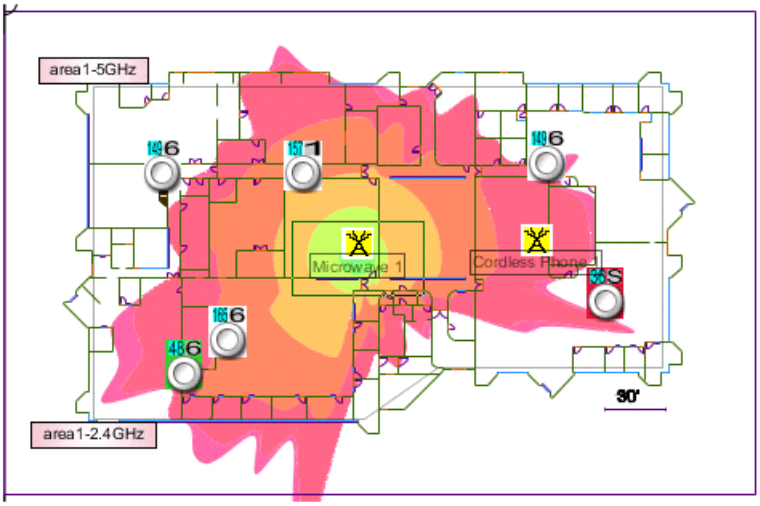
10. Once you have placed the Interference icon on the floor plan, you can visualize the effect of interference by clicking **RF Interference**.



11. The **Compute and Place** feature within RingMaster RF Planning now uses interference when calculating the number and placement of APs to provide effective coverage.
12. On the Network Plan, **Interference Noise** is displayed when there is noise present on the network. Clicking this in the Tasks panel displays the RSSI values across the floor.

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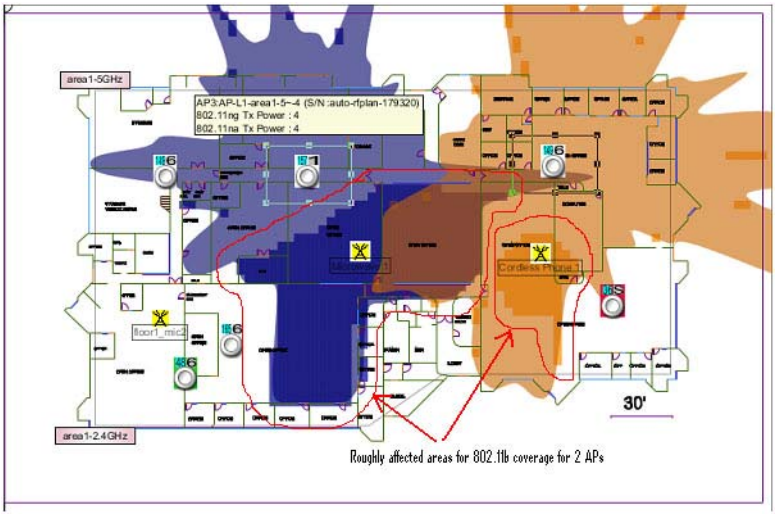
RF Coverage and Data Rate for Spectrum Analysis

For any RF Coverage or Data Rate information displayed on a Network Plan, clicking the Interference icon displays the coverage and data rate with interference from all the sources on the floor. Clicking the icon hides the previously covered areas if interference is sufficient to cause a drop in the data rate supported in the region. This is displayed by highlighting the area with a brighter version of the same color as the RF coverage or data rate.

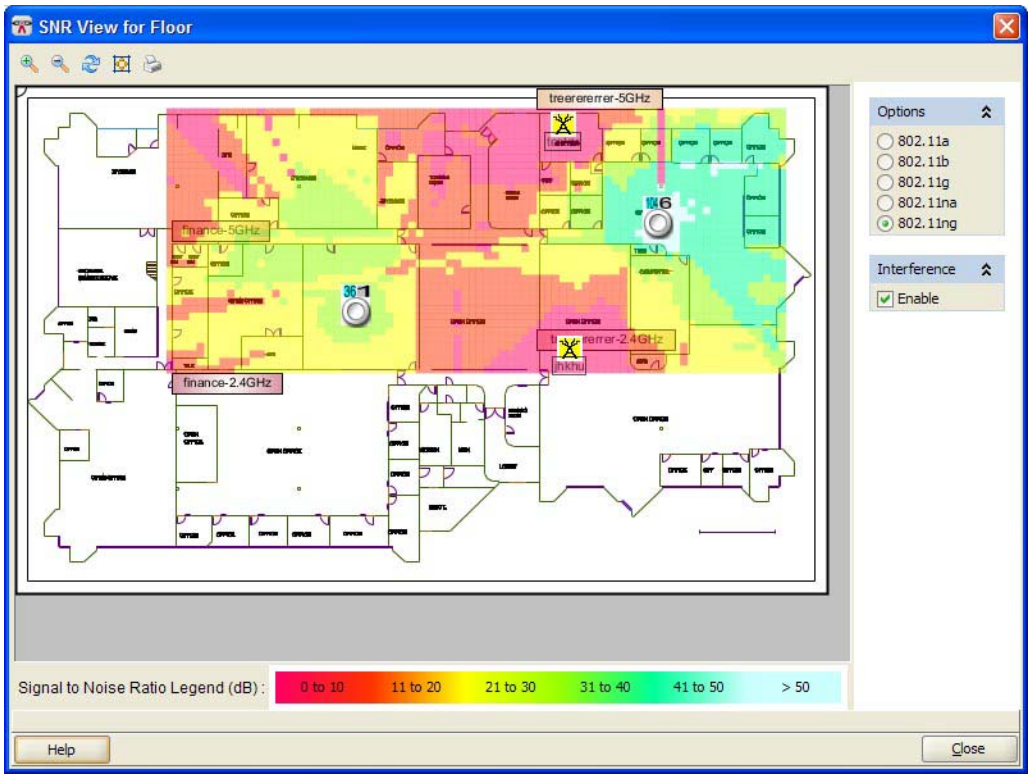


Viewing SNR for a Floor

SNR computation is performed according to the following process:

- For a given point on the floor, the AP with the highest RSSI is determined.
- RingMaster locates the interference that can possibly affect this channel. If any, then it is added to the noise factor. The interference may cause adjacent-channel interference which is included in the calculation.

SNR view now has a checkbox to enable or disable the display from an interference source.



Note: If there is no interference present on the floor, the option to view with and without interference is not displayed.

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Generating Reports on RF Interference

You can generate reports on RF Interference using the RingMaster Reporting tool. To generate reports, use the following steps:

1. On the Main navigation bar, click **Reports**.
2. From the list of **Available Reports** in the Organizer panel, select **RF Spectral Interference**.
3. For detailed reports on **RF Spectral Interference**, select **RF Interference Detail**.
4. In the **Report Options** section, you can select the scope of the reports with the following parameters:
   - **Report Scope Type**
     - **Site**
     - **Building**
     - **Floor**
     - **AP**
   - **Report Scope Instance**
     - **Network Plan Name**
   - **Report Time Period**
     - **1 Hour**
     - **24 Hours**
     - **7 Days**
     - **30 Days**
5. Click **Next**.
6. Select the **Report Format**. You can select **HTML**, **PDF**, or **XLS**.
7. To have the report e-mailed, enter an e-mail address.
8. Select the format of the e-mailed report. You can select from **Hyperlink** or **Attachment**.
9. To save the report on an FTP Server, select **Copy to FTP Server**.
10. Click **Next**.
11. Click on the hyperlink to view your report.

The following information is available in the report:

- **Report Type**
- **Date Generated**
- **Network Plan Name**
- **Scope**
- **Interference Source Type**
- **Last Seen**
- **Transmitter Id**
- **AP**

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- **Listener MAC**
- **Channel**
- **RSSI**
- **Duty Cycle**
- **CIM**

The RF Interference Summary Report is generate in the same manner as the Detail report. It provides a snapshot of Interference Sources and the types. It displays, as a graph, the Interference Source Type on the x-axis, and Count on the y-axis.

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